



# Using Long Range Ultrasonic Inspection for Challenging ECDA Situations

- > DOT R&D Forum  
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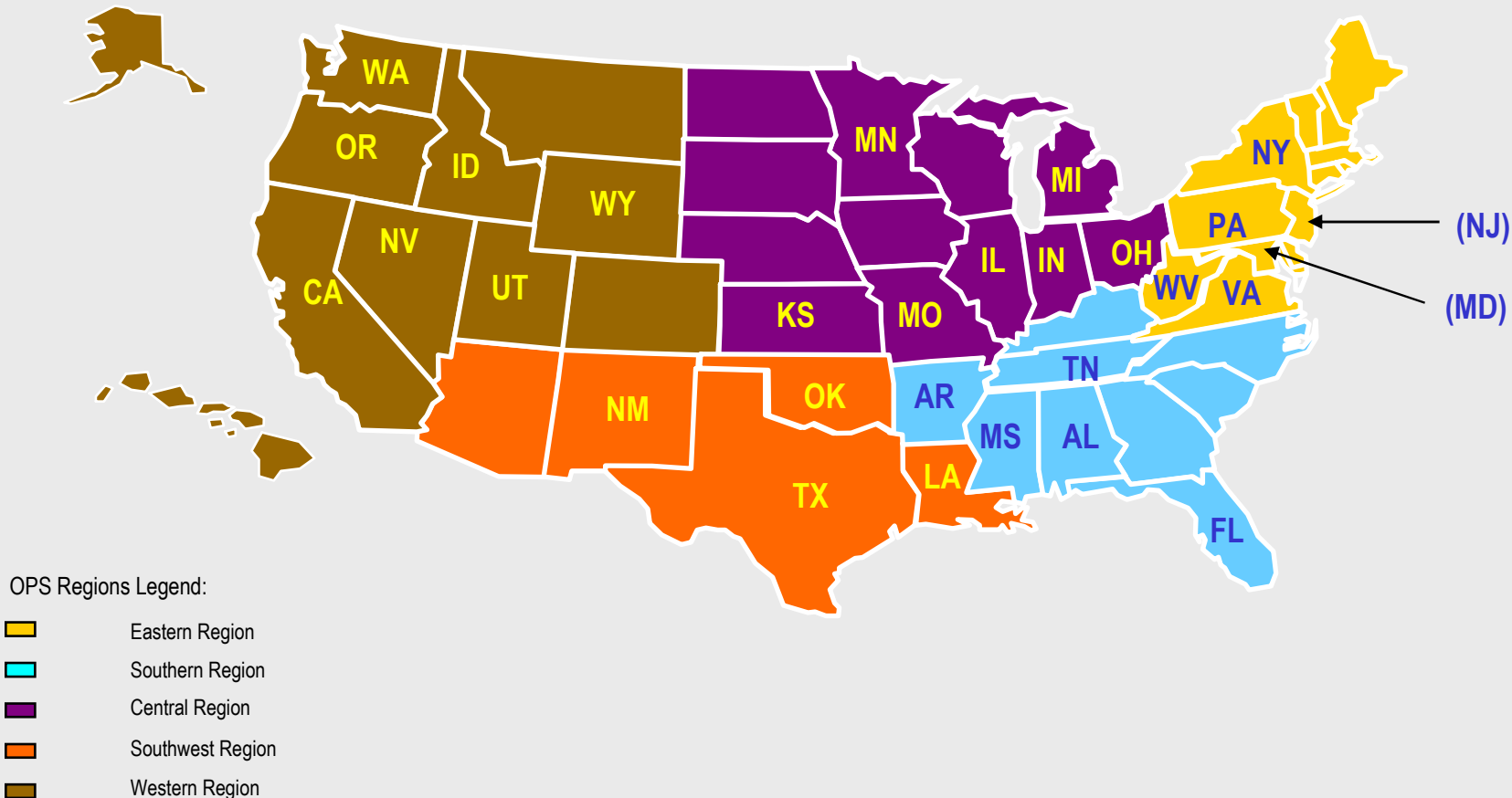
# Gas Technology Institute

- > Independent, not-for-profit research and testing organization, founded in 1941
- > Testing and evaluation, technology development, education, informational services
- > Natural gas, energy, and environmental research focus
- > Headquarters: Des Plaines, IL (Chicago area)
  - 300,000 sq-ft facility on an 18-acre campus
  - Laboratories, test facilities, library, classrooms, offices
- > Staff: Over 200: Des Plaines, other states, and DC



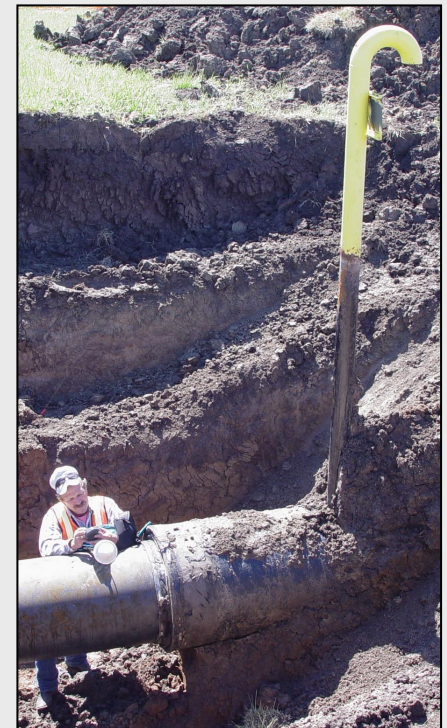
# GTI PIM Research Participants

- > Over 40 companies in five regions have participated in GTI's ECDA and ICDA Research programs from 2002 to 2007.
- > This has included a wide breadth of operational and regulatory environments and conditions.



## ECDA Gaps/Challenges

- > ECDA is "process based" and employs/relies upon aboveground inspection tools.
- > These tools rely on a way to measure voltages and/or electromagnetic signals between the ground surface and the pipe. Many also rely on breaks in a non-conductive coating to alert the presence of an "indication" or potential area of concern that may require an excavation.
- > *Challenging* situations include cased pipe segments (which are removed or shielded from the surrounding soil); shielded, disbonded coatings; and bare pipe. These situations negate nearly all of the standard assessment tools currently employed.



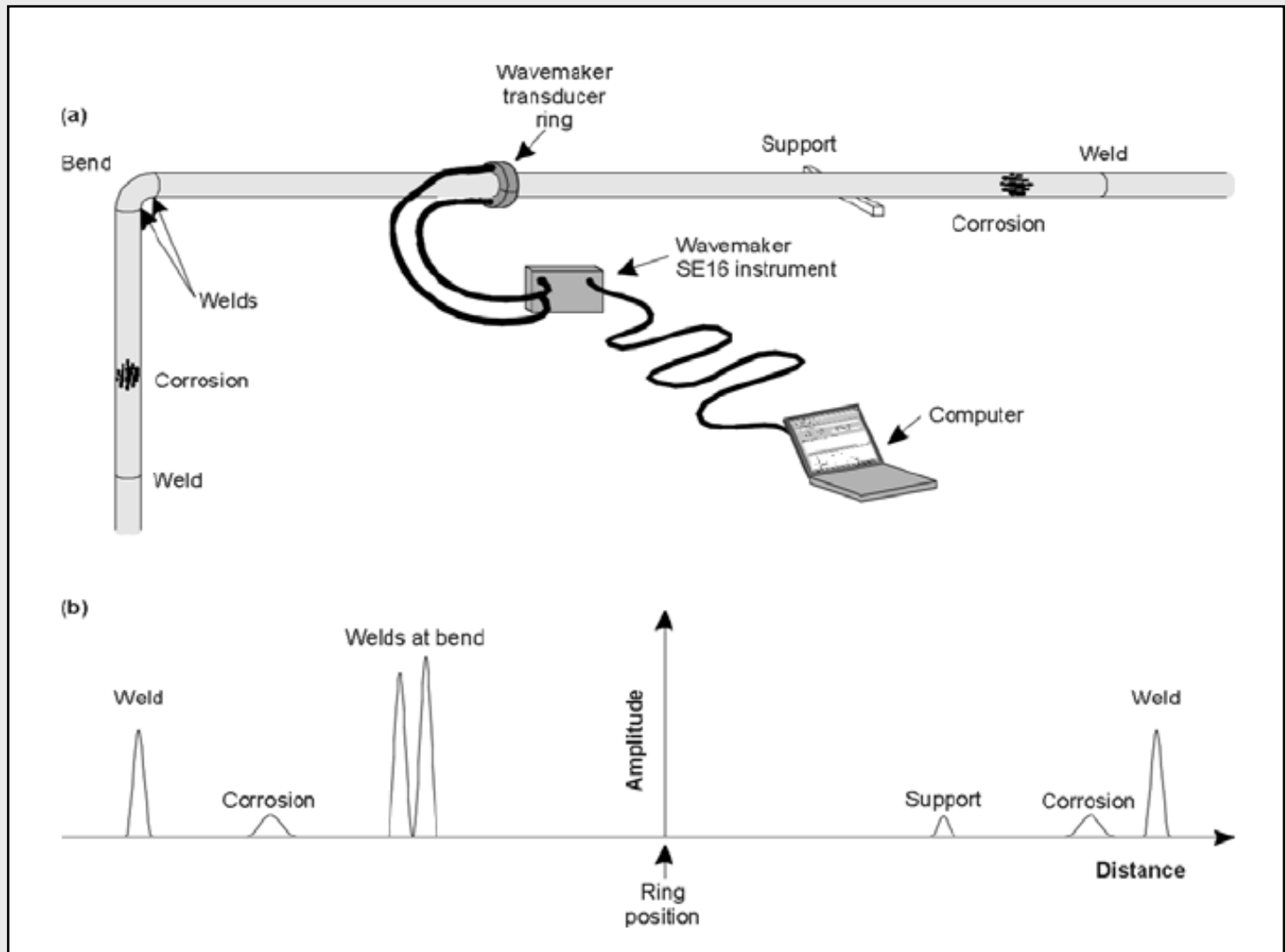
# Ongoing Research (1)

- > GTI is currently conducting a PHMSA/DOT and Industry sponsored ECDA Project, DTPH56-06-T-000001 "Demonstration of ECDA Applicability and Reliability for Demanding Situations".
- > This project includes the identification and demonstration of specific technologies to assess demanding pipeline situations.
- > This includes situations such as cased and non-cased crossings, pipe with no coatings (bare) or shielded/disbonded coatings, and segments with interferences from multiple pipes in right of ways (e.g., city gate stations).

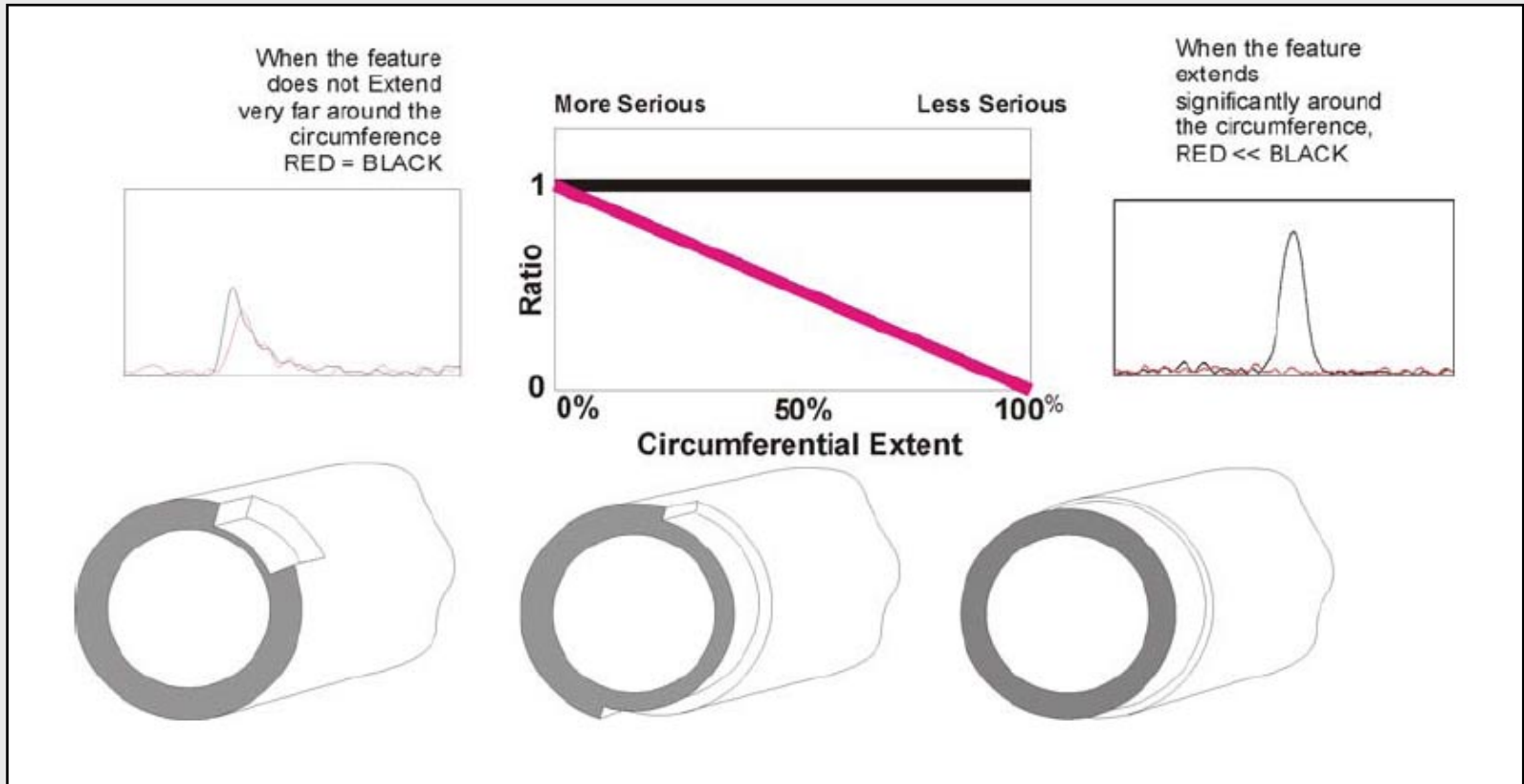
# Ongoing Research (2)

- > The results will include expected reliability numbers for defect identification for the particular situation.
- > These results and recommendations will be reviewed and fed into industry standards and recommended practices (e.g., ASME and NACE).
- > This project includes support from a group of 23 gas company participants. Five Local Distribution Companies (LDC's) have contributed transmission pipeline segments for assessment, pipe inspection resources, and excavation and examination costs to demonstrate the potential DA technologies (pitch-catch guided wave, C-Scan guided wave focusing technology, magnetic tomography, etc.).

# Guided Wave Set-up – Basic Explanation

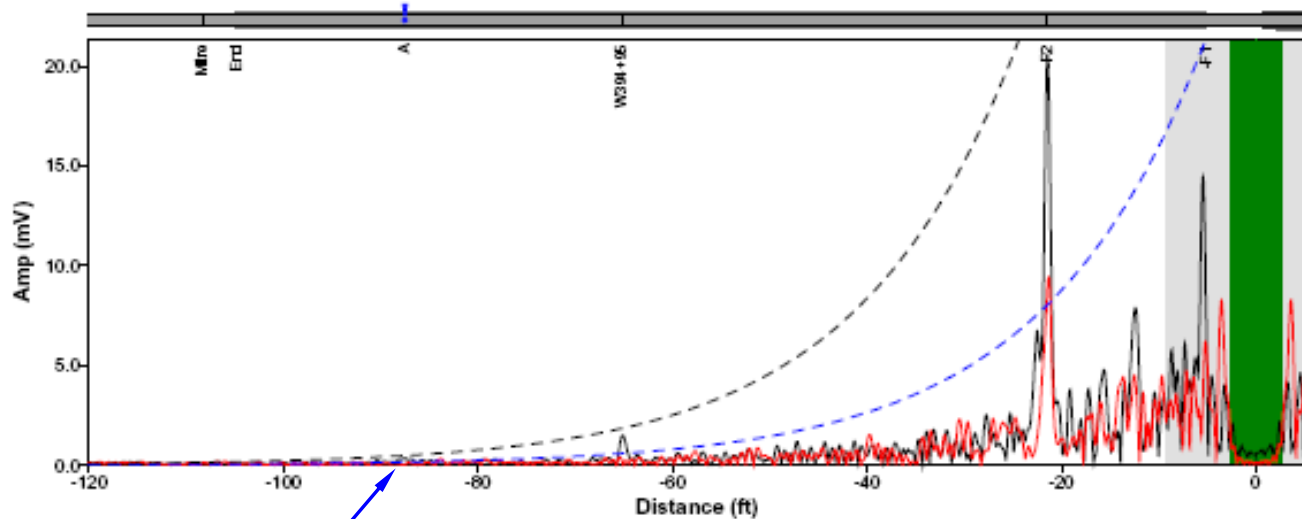


# Guided Wave Inspection-Reflection Plot Explanation

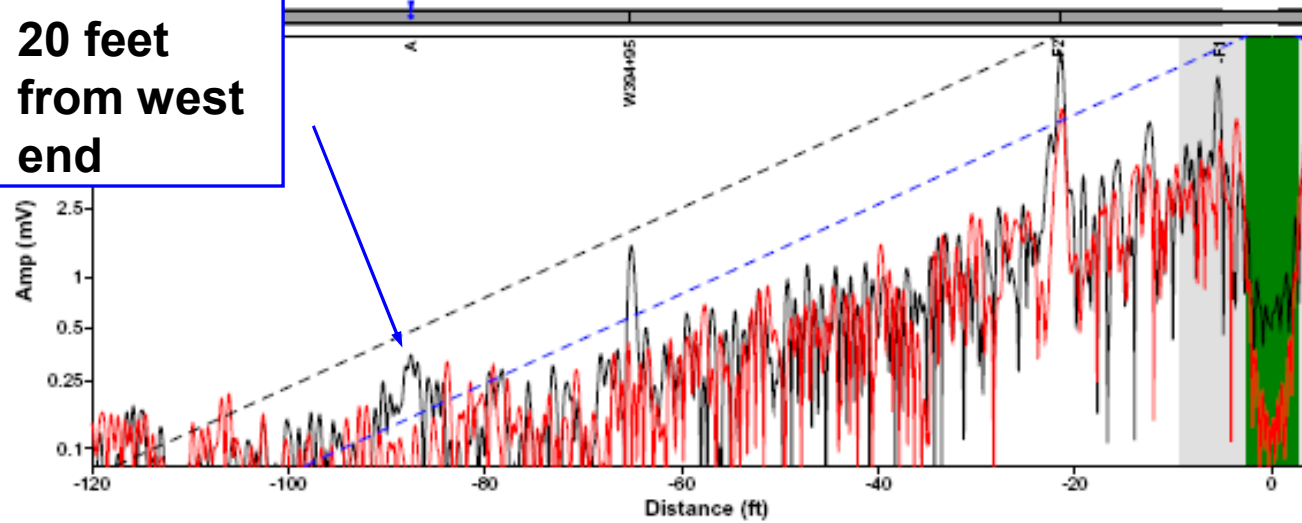




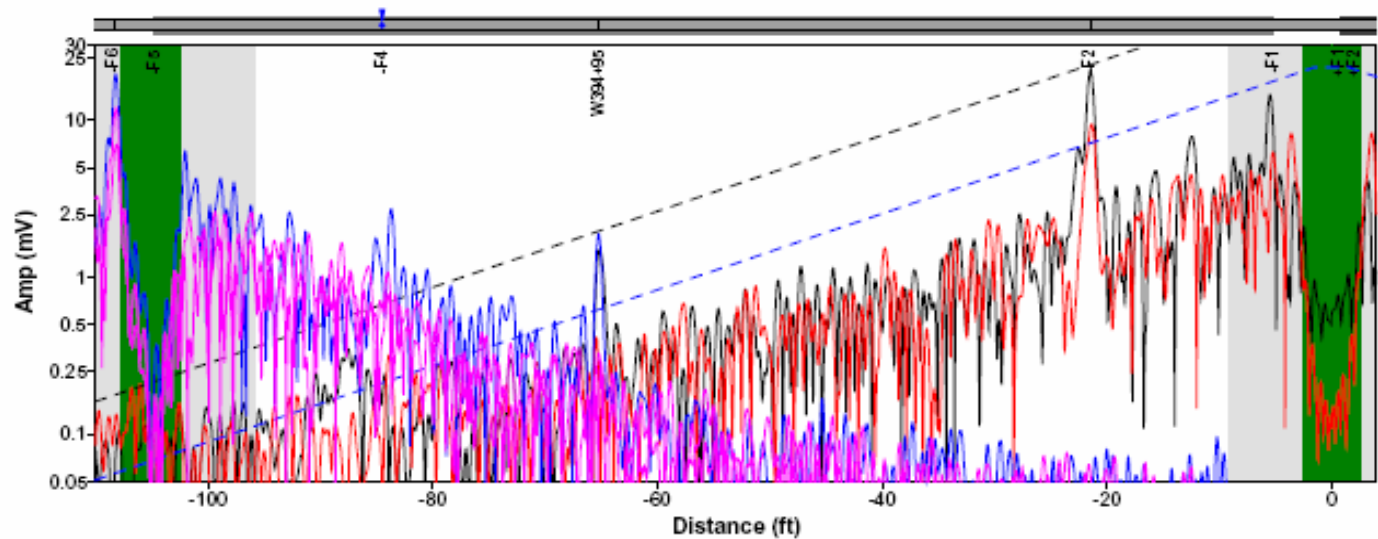
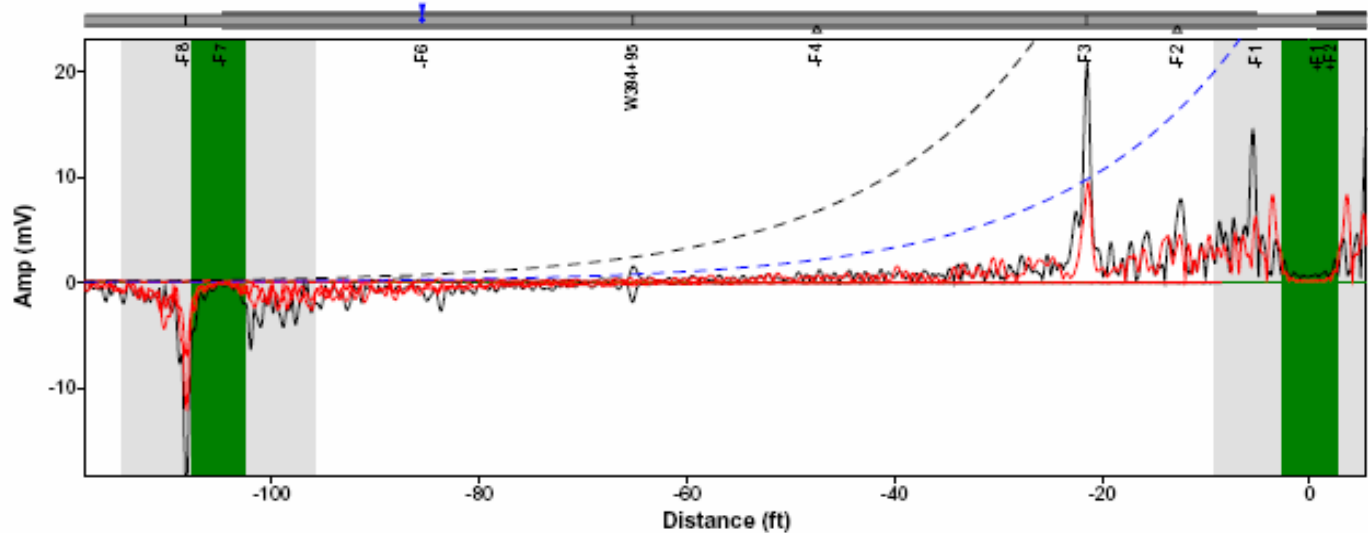
# Linear vs. Log Display



Feature at 20 feet from west end



# Overlaid Scans from Both Casing Ends



# Transducer Ring



# Scan Underway in the Ditch



# ECDA Gaps/Challenges – Bare Pipe

- > Bare Pipe: *Pitch-Catch* UT; Magnetic Tomography; and Direct Exams.
- > Initial results of LRUT indicate good correlation with direct exams but limited range of effectiveness due to attenuation of signals on rough pipe in clay soils.
- > Magnetic Tomography performance results are currently mixed.
- > Shielded, disbanded coatings field work is planned for early 2007.



# ECDA Gaps/Challenges – Crowded Areas – City Gate (Meter/Regulator) Stations



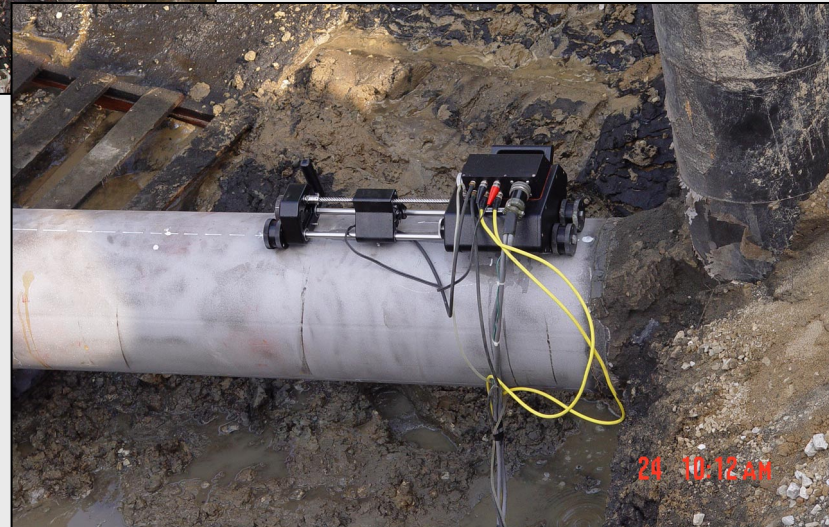
- > City Gate Station – Recently used pitch-catch across tee's and wall penetrations with good success. Initial comparison against radiography, magnetic particle inspection, and portable/direct contact beta scan (UT) have confirmed inspection results.

# ECDA Gaps/Challenges – Crowded Areas – City Gate (Meter/Regulator) Stations

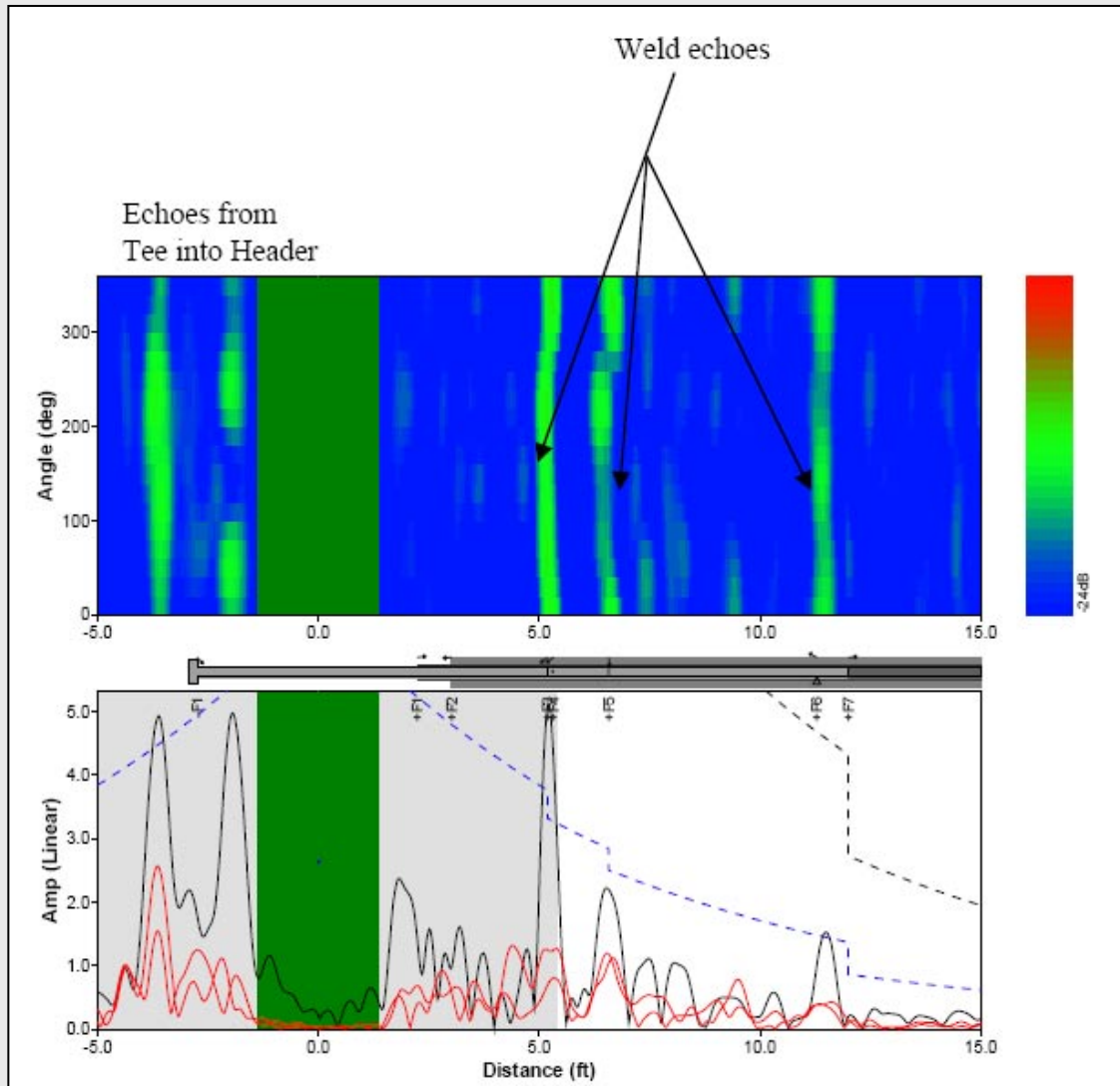


- > Direct Exam with Magnetic Particle Inspection - Welds and Pipe Surface.

- > Direct Exam of Pipe Wall with Portable Ultrasonic Beta Scan Unit.



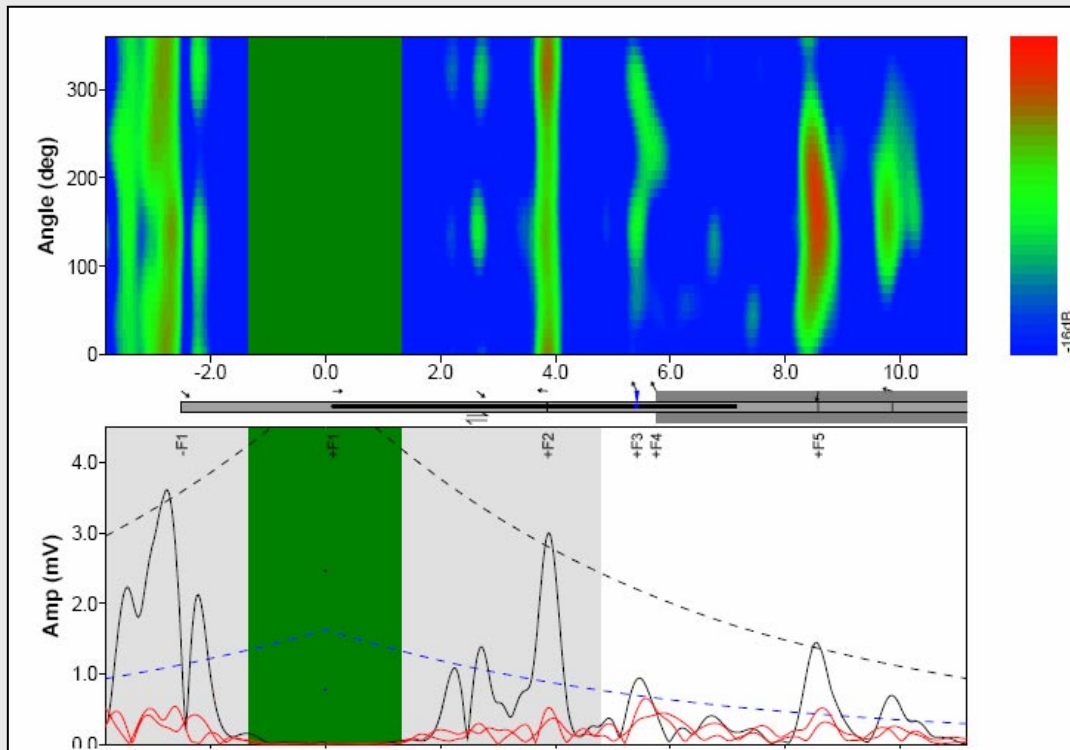
# Guided Wave C-Scan Presentation



- > C-Scan (focusing technology) result on 12" buried pipe.
- > Circumferential location of indications can be displayed.
- > Initial comparison with direct exam is promising.
- > This inspection correctly predicted no defect.



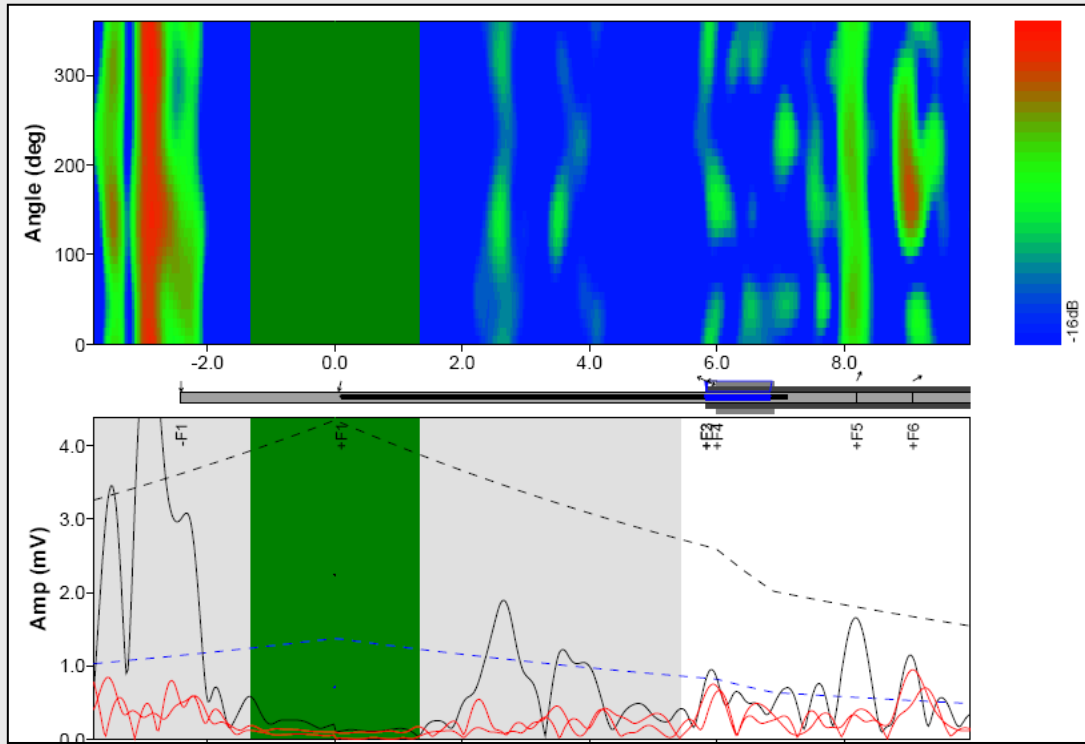
# C-Scan of Corroded Area #1



- > C-Scan *focused* presentation of the reflections from the area just before a Link seal are localized towards the bottom of the pipe (at an angle of about  $180^\circ - 240^\circ$ ).
- > In particular, the reflection at about 5ft 6inch from the transducer ring is concentrated and was confirmed as corrosion.
- > Picture (to the left) of the corrosion from the 4 o'clock position looking in the positive direction from the transducer ring (about  $230^\circ$ ).



## C-Scan of Corroded Area #2

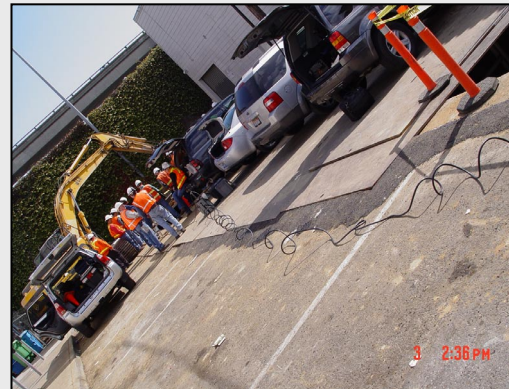
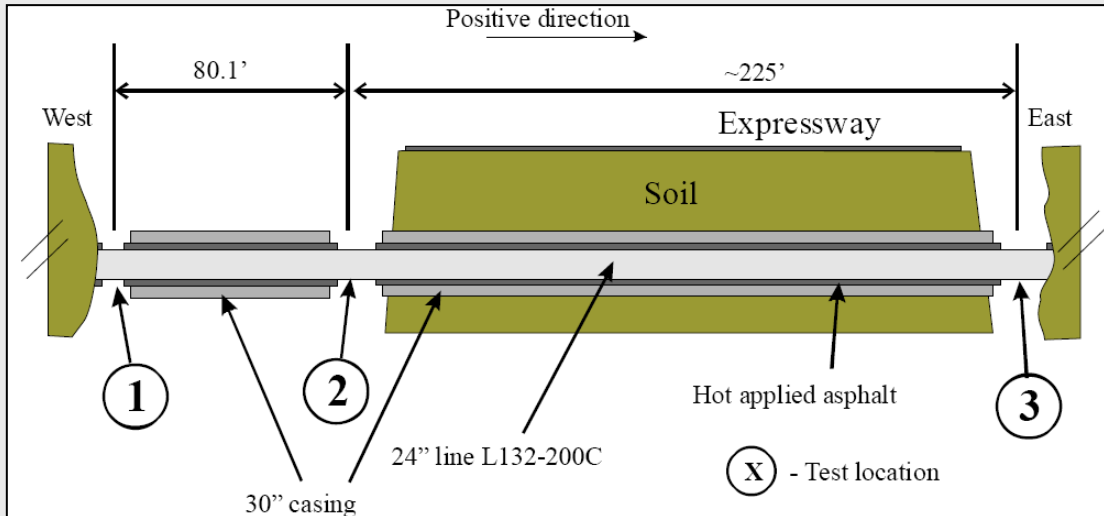


- > The reflections from the Link seal area are localized towards the bottom of the pipe (at an angle of about 160° - 240°).
- > In particular, the reflection at the entrance is concentrated and could be visually seen to be corrosion during the subsequent direct exam.
- > Picture of the confirmed corrosion from TP6 (5C) at the 6 o'clock position or bottom of the pipe (about 180 deg).



# ECDA Gaps/Challenges – Cased Crossings

- > Continues to be a challenging situation based on range, signal strength, sensitivity, etc. More work planned in 2007 in class 4 locations.



# Next Steps for PHMSA Project

- > Continue analysis of inspection data from recent case studies, i.e. tools used, what was predicted, and what was actually found (% Reliability of Prediction).
- > Data will be combined with in-kind (past) project data to form a comprehensive "Selection Matrix" with % Reliability numbers for each tool's (primarily guided wave technology) performance for a demanding situation (e.g. cased crossing).
- > Continue drafting of "Demanding ECDA Situations Procedure". When combined with the "Selection Matrix" noted above, these will form a two-part set to assist with the proper selection of tools for particular demanding situation. Upon completion of the Demanding Situation "Procedure" & "Selection Matrix", a summary will be drafted for review by ASME and NACE for possible inclusion into their appropriate consensus standards.

# ECDA GAPS Still to be Addressed

1. Long Casings (currently there is a limited range with LRUT).
2. Bare Pipe and Thick Coatings (attenuation issues).
3. Statically meaningful (and locally relevant) Corrosion Growth Rates.

# QUESTIONS ?





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