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Fatigue Flaw Reference Standard Development for NDE

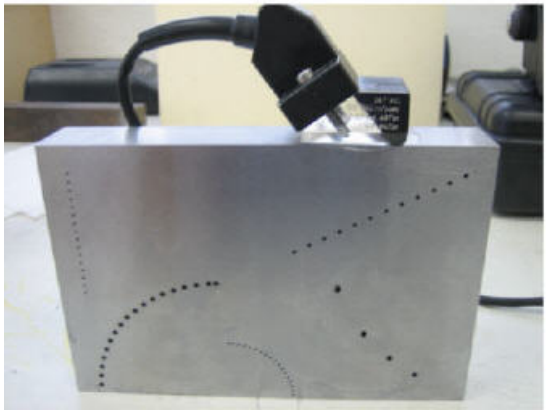
Dash Weeks

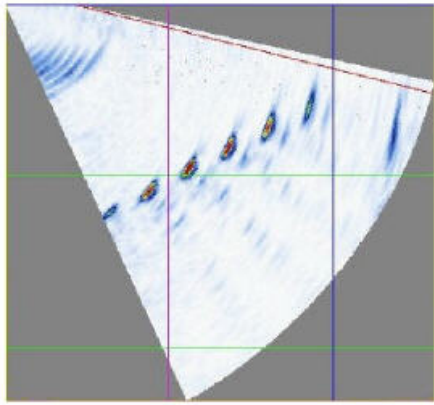
DOT/PHMSA Government/Industry Pipeline R&D Forum – Aug 6-7, 2014

The Problem

- Current inspection technologies use calibration references made with machined artifacts.
- Machined artifacts give excellent signals that are easily interpreted with minimal errors.

Real flaws give poor signals that are difficult to interpret and have large errors





The Solution

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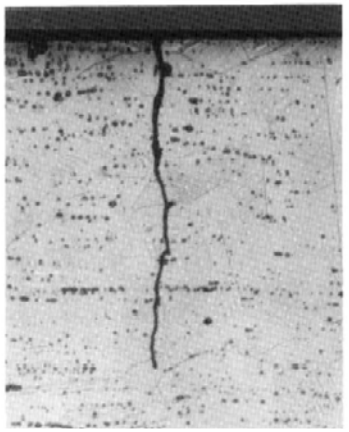
Calibrate with representative flaws

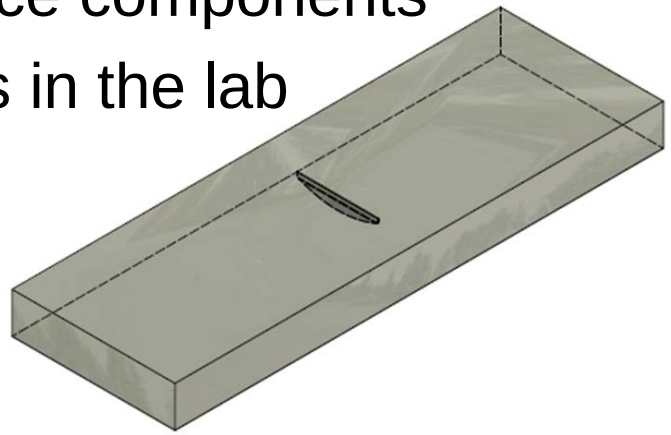


Calibration of NDE equipment with signals that are similar to those found in the field….

or LAB

The Solution has Problems

- Representative flaws are available from
  - In-service failures
  - Replacement of in-service components
  - Generating fatigue flaws in the lab



However these are consumable references that are limited in supply, expensive and not useful for in-field verifications

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A Better Solution

- Non-Consumable Fatigue Flaw References
- With the same features already accepted in consensus standards and used in the field by the inspection industry

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Phase 1 – Feasibility Study

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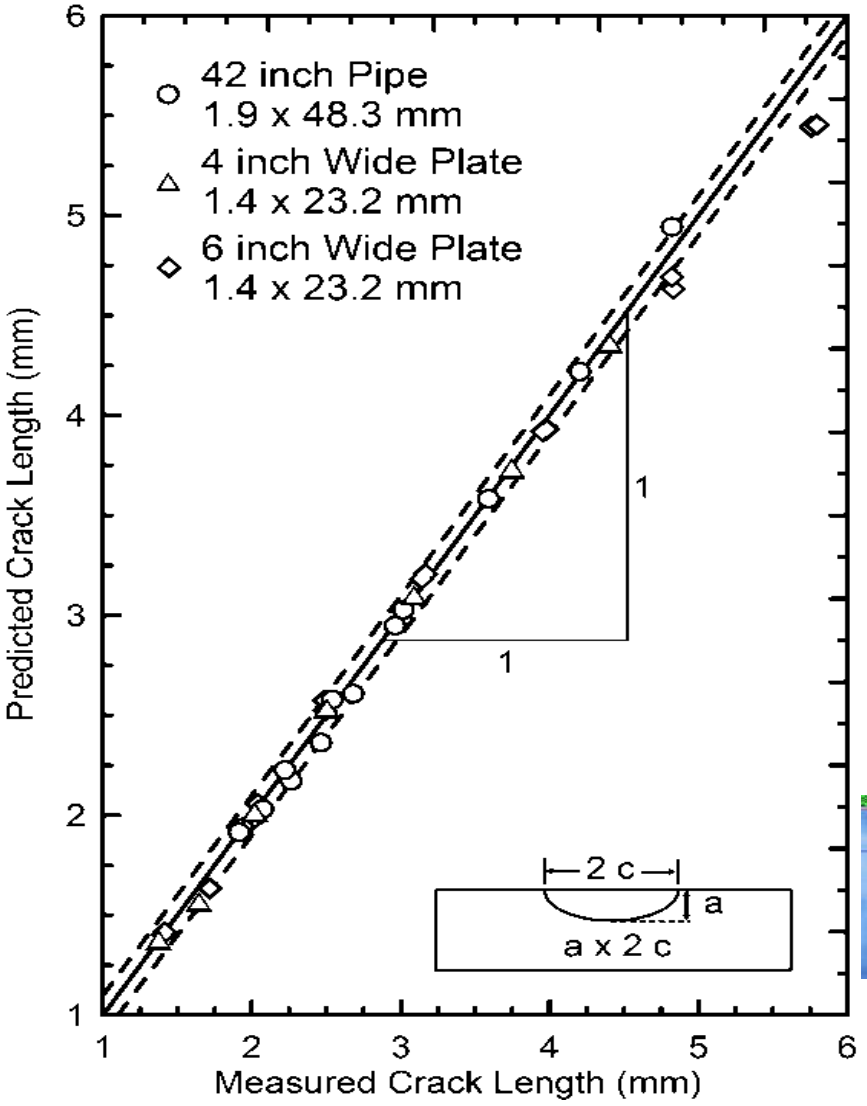
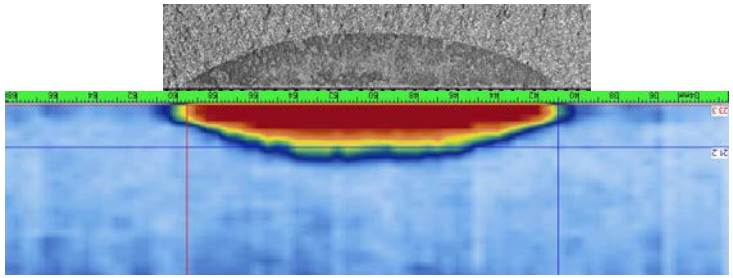


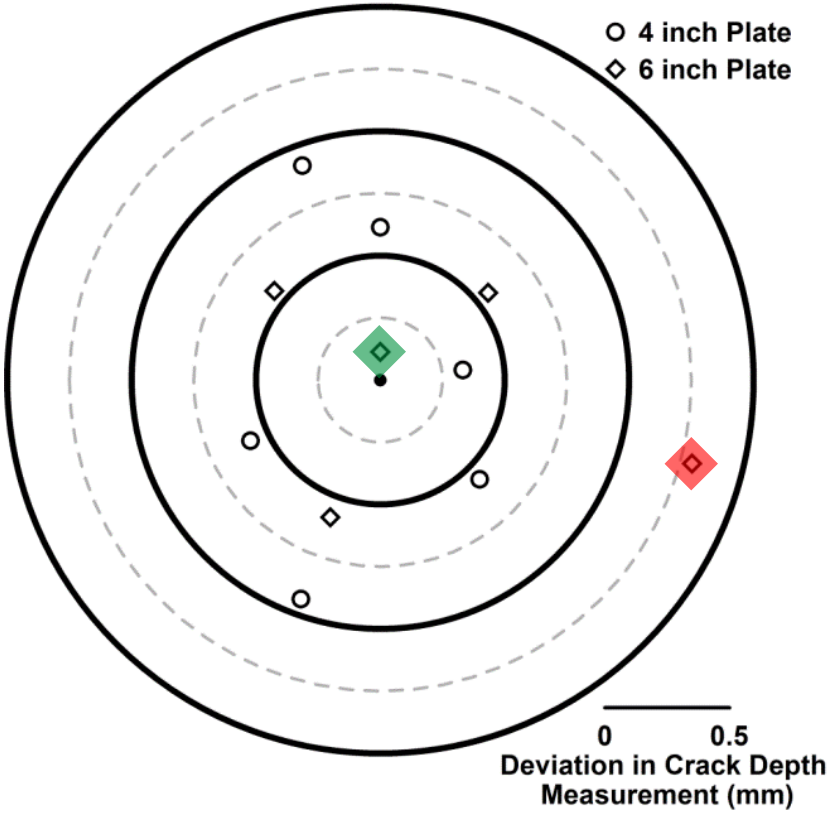
Our goal is to be at least an order of magnitude better at producing reference flaws as the industry is at measuring them.

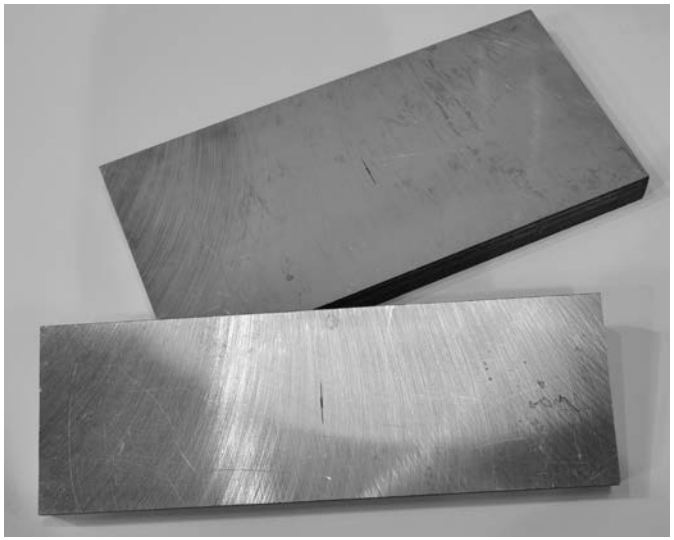


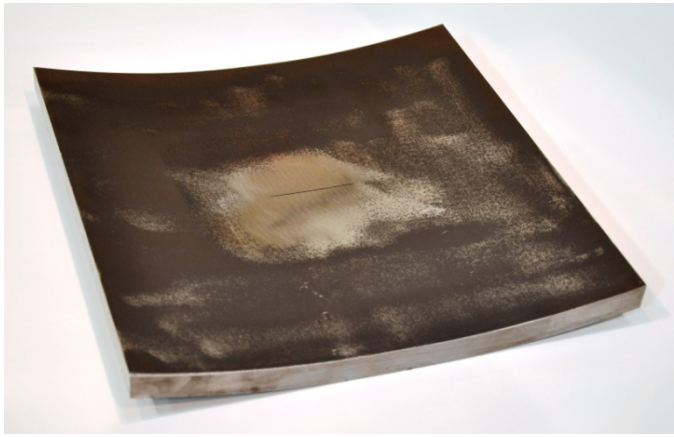
NIST

Phase 1 – Feasibility Study

- Proof of concept
- Demonstrated Need







X80 – 42” diameter pipe

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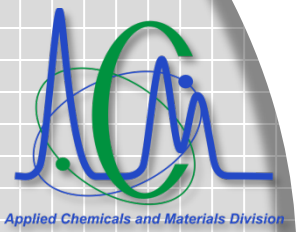
Phase 2 - Expansion



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- Added real time analysis during cracking
- Improved prediction models
- Improved initial notch measurement

Aimed at improving manufacturing precision and accuracy

- Four Flaw Geometries
- Two Plate Widths
- Prediction Difference < 0.1 mm Actual

Phase 2 – Improving the Process

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Next Steps

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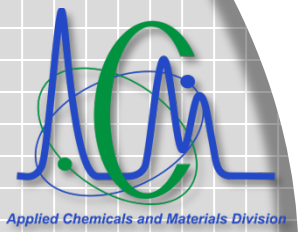
Twelve Vendors to evaluate references

- Two plate widths
- Four flaw geometries
  - Three unknown flaws
  - One known flaw

Iterate manufacturing of other prototypes to create references of various shapes and purposes but with the addition of a fatigue flaw.

Need to Know



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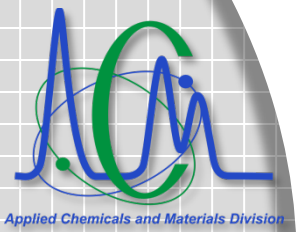
1. Can vendors use the one known flaw geometry to calibrate systems to detect and measure other flaw geometries?
   - What are the errors associated with the range?
   - How do the results compare to “initial” calibration?

2. What effect is there by calibrating to a different known geometry?

Outstanding Need

- Vendors needed to participate
  - Made available at a single location
  - Shipped to vendors
- True blind study – participation is only acknowledged with vendor approval and results will not be associated with vendors.
- Different NDE techniques are welcome!

Thank You!



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