Magnetostrictive Sensor Monitoring Technology (MsSMT) for Low-Cost, Long-Term Monitoring (Patent Pending)

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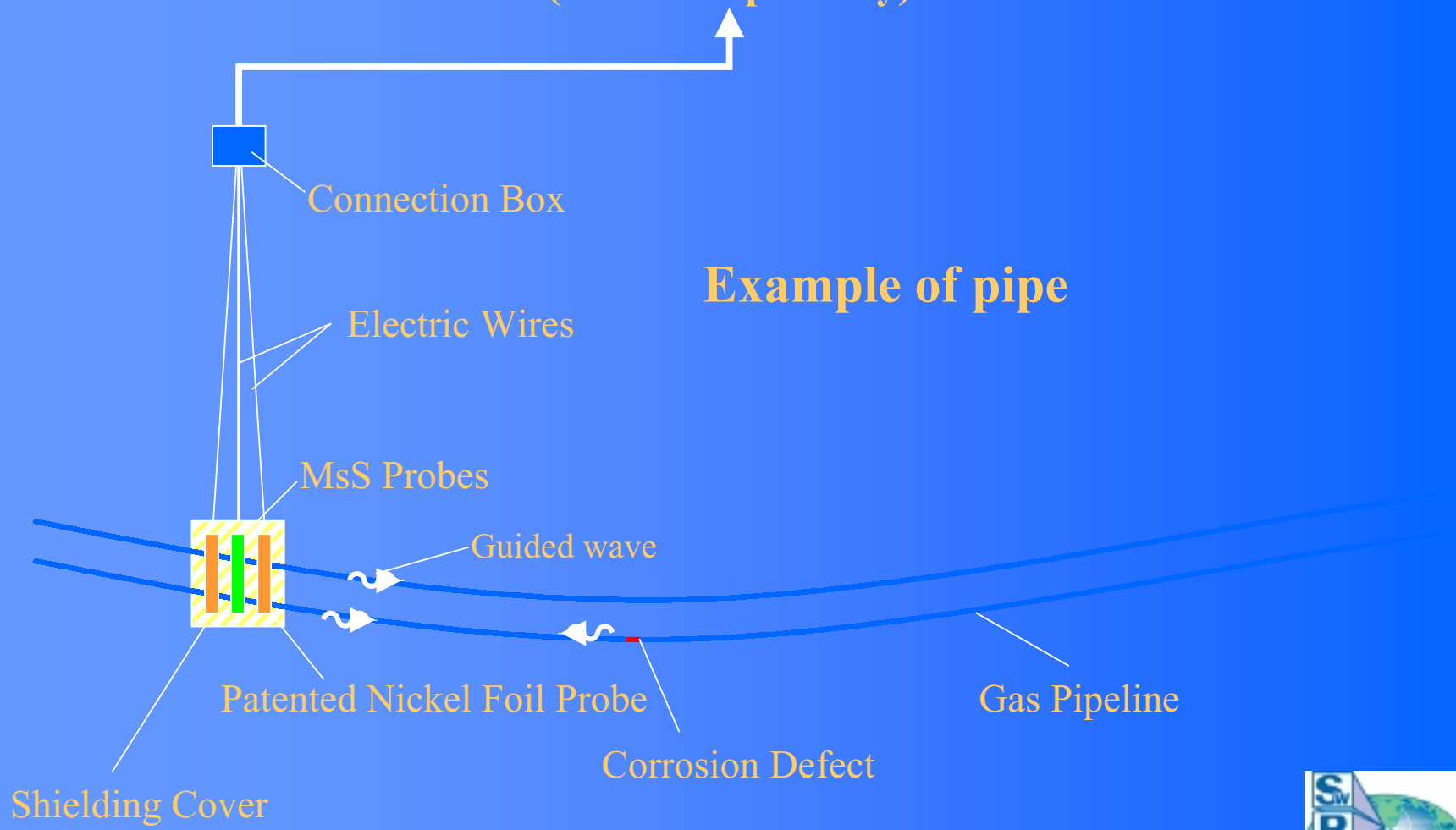
Problems

- Internal and external corrosion can occur at many places along pipe or plate
- Detection of corrosion using periodic inspection techniques are time consuming and can often occur only during plant shutdown
- New technology is needed to detect corrosion in the early stages using a monitoring process without shutting down the plant
- This process needs to be low cost and provide long-term capability

Magnetostrictive Sensor Monitoring Technology(MsSMT) (SwRI Proprietary)



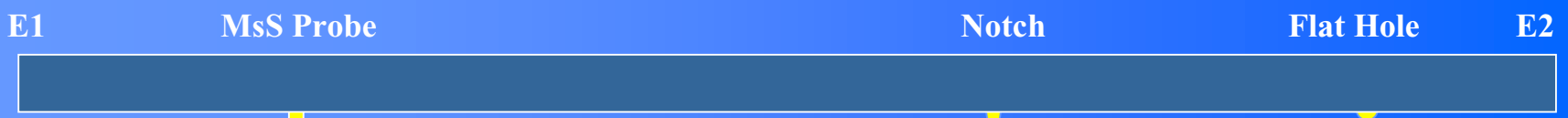
Technical Approaches

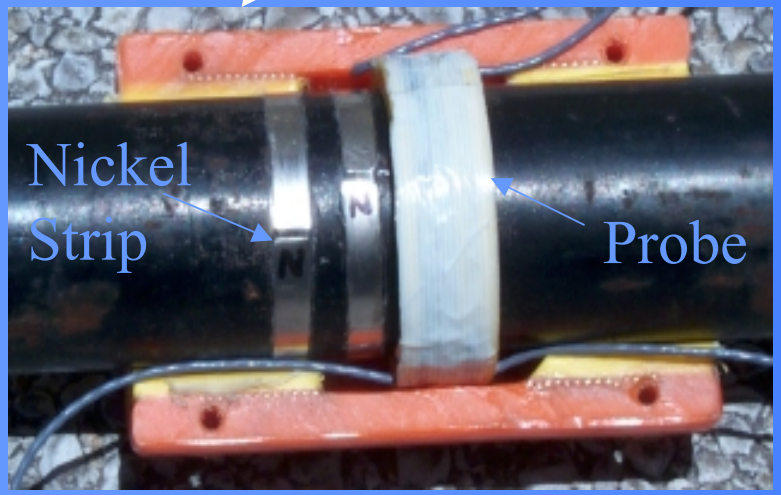
Install torsional wave magnetostrictive sensor (MsS) at a corrosion-sensitive region on a pipe or plate and obtain baseline data

Periodically test the pipe or plate with a guided wave using MsS

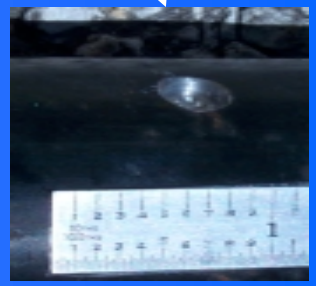
Compare new data with the baseline data and find any changes using a suitable algorithm.

Laboratory Experiments Using MsSMT for Notch and Hole in 1.9-Inch-OD, 0.15-Inch-Thick Steel Pipe (SwRI Proprietary)



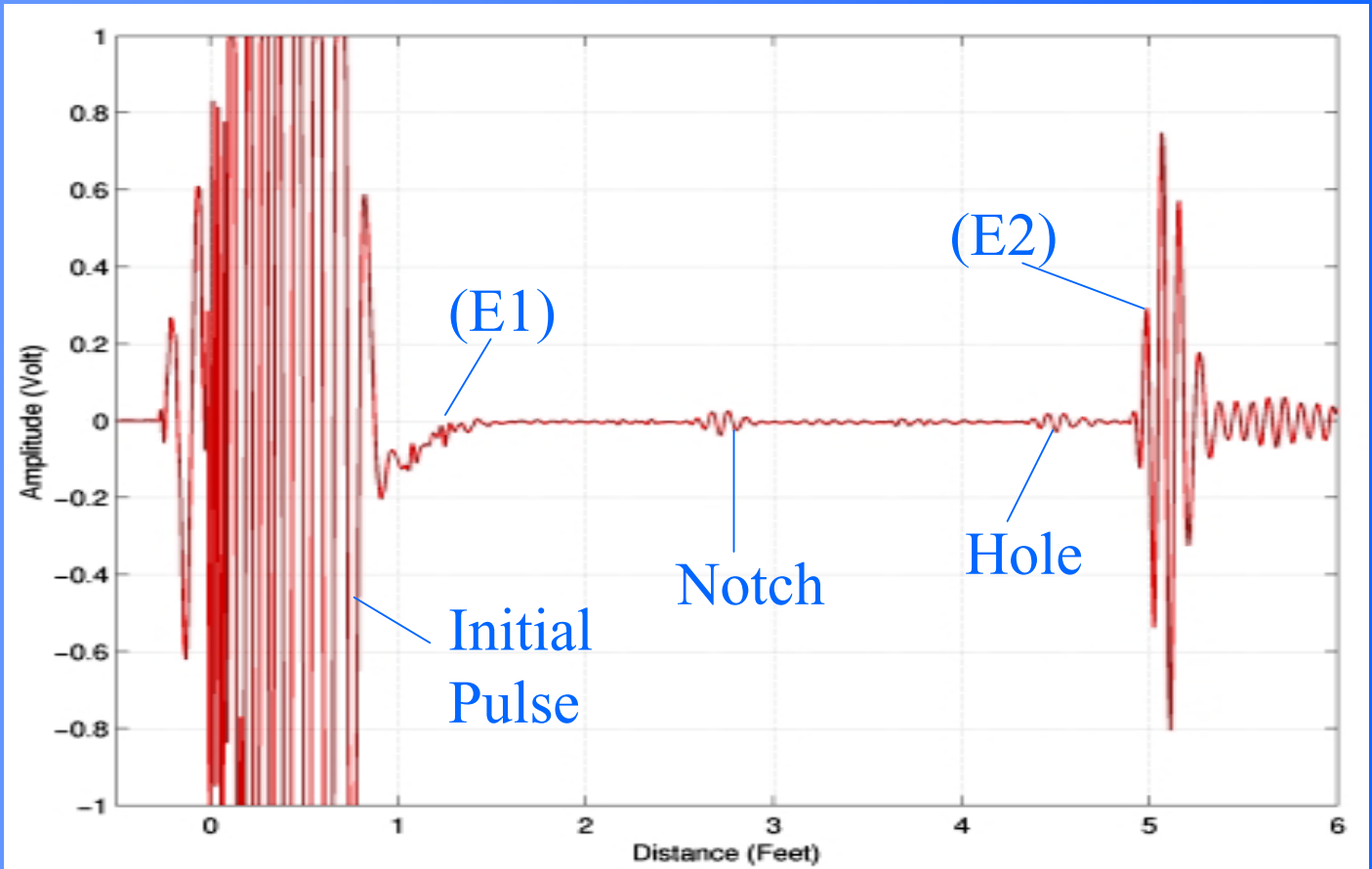


5/8-Inch-Long, 0.075-Inch-Deep Notch (4.1 %)



3/8-Inch-Diameter, 0.075-Inch Deep Hole (3.1 %)

Torsional Mode Signal in Steel Pipe with Notch and Hole (SwRI Proprietary)

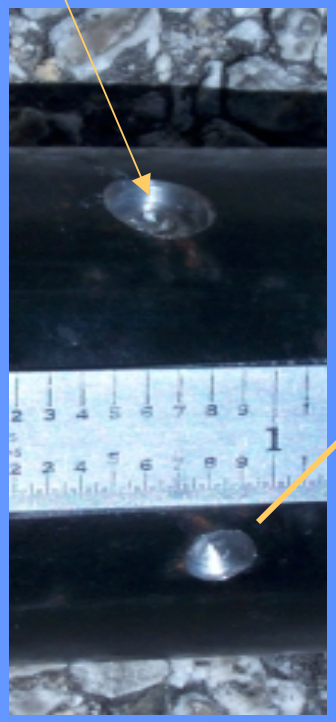


Example of MsSR-1000™ and MsS Probe Wrapped Around a 24-Inch-OD Pipe to Generate a Torsional Wave (SwRI Proprietary)

Size and Cross-Section Area of Hole Made for Monitoring Corrosion Defect Growing in a Steel Pipe (SwRI Proprietary)

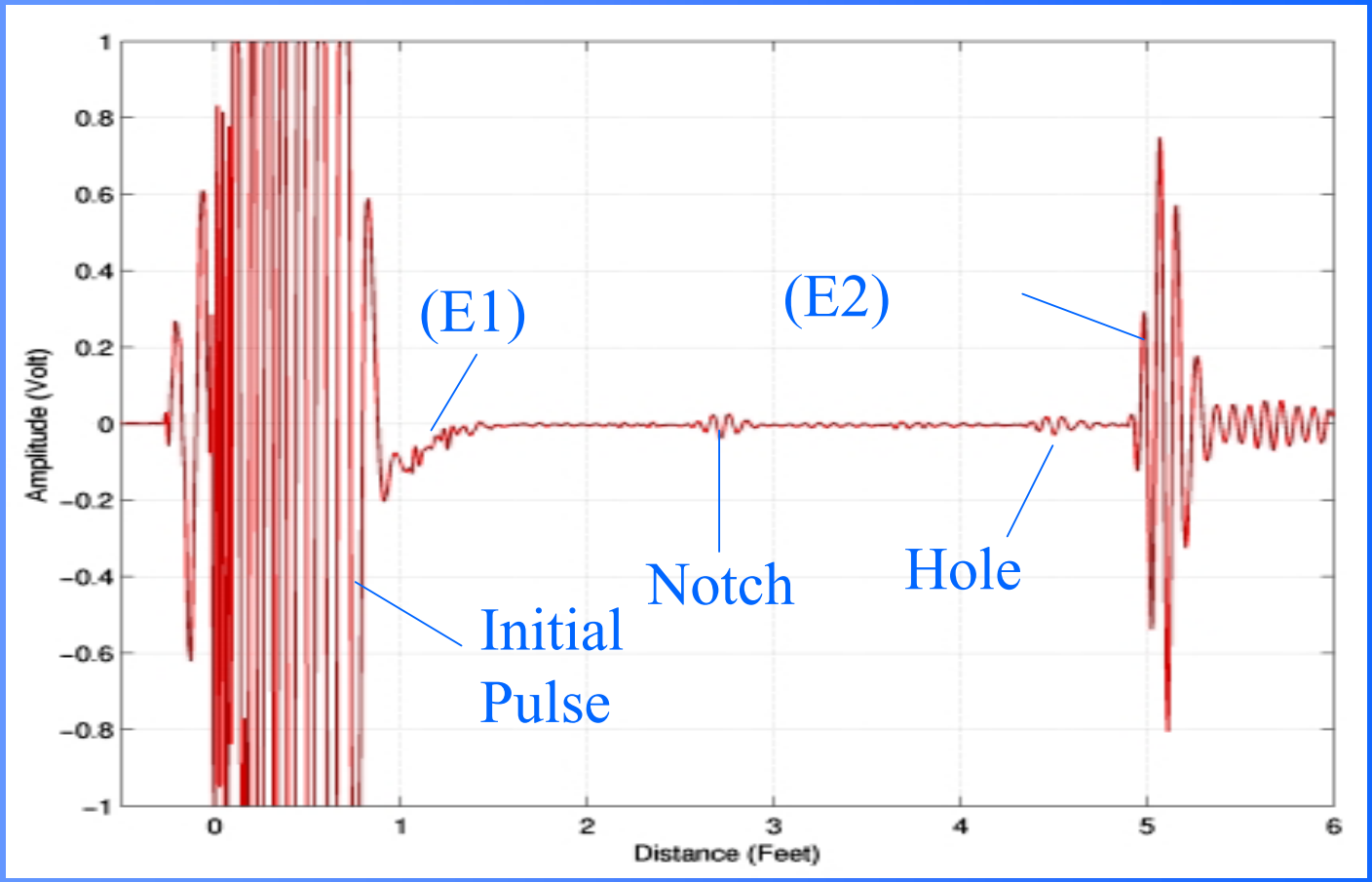
3/8-inch-diameter,

0.075-inch deep Hole

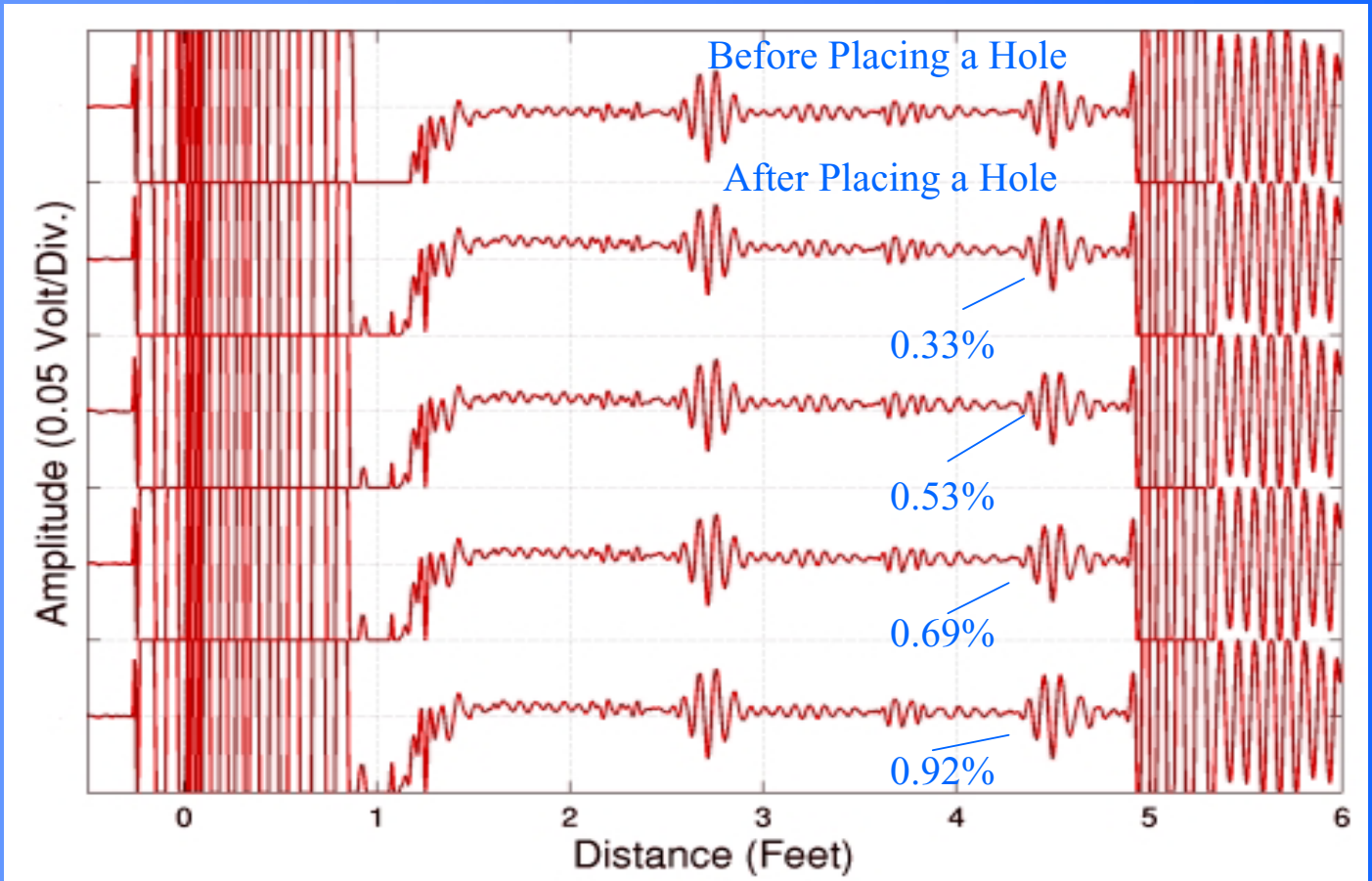


Diameter (Inch)	Depth (Inch)	Cross Section Area (%)
0.073	0.05	0.33
0.073	0.073	0.53
0.104	0.073	0.69
0.203	0.073	0.92

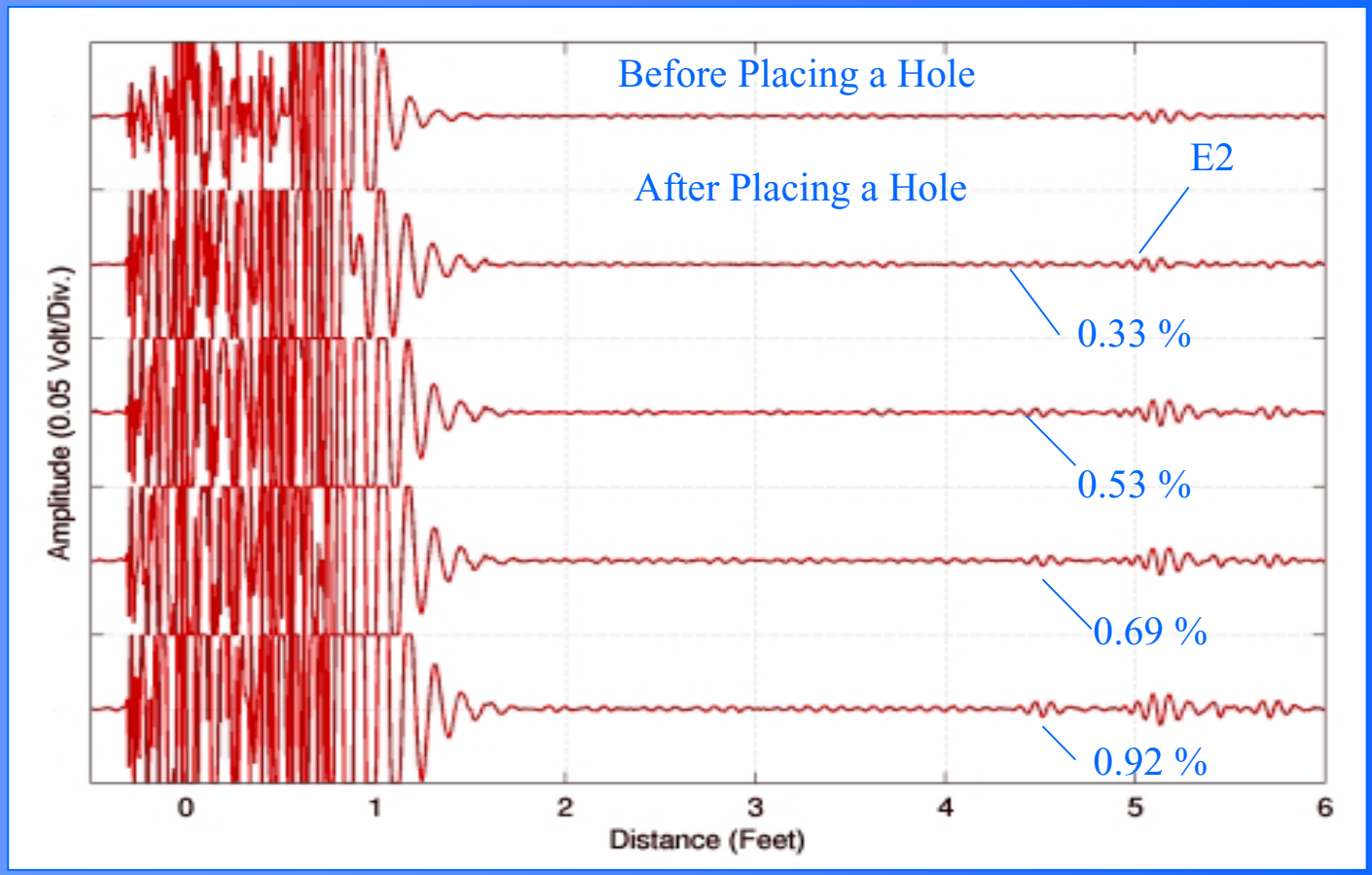
Torsional Mode Signal in Steel Pipe with Notch and Hole (SwRI Proprietary)



Inspection Processes for Steel Pipe with a Defect Growing Next to the 3/8-Inch-Diameter, 0.075-Inch-Deep Hole (SwRI Proprietary)



Results After Applying Waveform Differential Algorithm in Time Domain to Monitor Hole Growth (SwRI Proprietary)



Future Research

Investigate magnetic field property variation of ferromagnetic strip used for the torsional wave monitoring process

Conduct laboratory and field demonstrations of the MsSMT with MsS and torsional wave coils on pipe and plate in the following industries:

- Petrochemical
- Power plant
- Buried pipeline