PRCI Project Ref: MD-1-1

QUARTERLY REPORT – PUBLIC PAGE

Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage

Date of Report: October 31, 2007

Contract No: DTPH56-06-000016

Prepared For: United States Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Office of Pipeline Safety

Prepared By: Alex Rubinshteyn
Principle Investigator
Rosen USA, Inc.
14120 Interdrive East
Houston, Texas 770032
832-472-0329
ARubinshteyn@Roseninspection.net

Mark Piazza
Team Project Manager and Technical Coordinator
Pipeline Research Council, International
1401 Wilson Blvd., Suite 1101
Arlington, VA 22209
703-387-0190
mpiazza@prci.org

For Period Ending: October 31, 2007

Technical Status

Mechanical Design and Magnetic Design:

The mechanical and magnetic designs of the tool remain unchanged since the last quarterly report.

Software and Algorithm Development:

The functions of the different algorithms were described in the last quarterly report and work continues on software development. The scaling algorithm was completed using finite element model data received and the feature detection, feature boxing, correlation and subtraction algorithms are complete, barring any changes that need to be made after testing. The algorithms and software will be tested beginning the first week of November using pull test data, and will be further integrated to work together.

Manufacturing and Assembly Status:

The low and high field segments of the tool have been manufactured and assembled, and the caliper arm segment is currently being assembled. The tool will be complete and available for the test run which is tentatively scheduled for December and will be available for pull tests that are taking place in November.

Pull Tests:

As discussed in the previous quarterly report the pull tests will take place using a section of pipe with a single dent in it and a three meter long dented section of pipe. The three meter section of pipe has been welded between two five meter long sections; all three sections were cut from the same pipe. The dented section of pipe is welded onto the end of one of the five meter long sections. The pull test arrangement can be seen in Figure 2. The pipe section placement is to ensure that when the pipe wall surrounding a dent is magnetized each of the magnetizer poles will be on a section of wall with the same thickness and material properties. Additionally although the section of pipe supplied by Enbridge is at the end of the pull test pipe assembly the dent is in the middle of the Enbridge section, and thus the poles of a magnetizer section will be exposed to the pipe steel and not to air as the magnetizer is traversing the dent.

The defects installed in the test piece were chosen to meet the following goals:

- Validate tool performance by comparing decoupled signals obtained from the dual magnetization prototype tool to signals obtained from the Rosen tool for the same dent geometry & dimensions. This is the primary goal.
- Examine the effects of dent geometry on a signal by varying the indenter but keeping the dent depth constant.
- Examine the effects of dent depth on a signal by varying the depth while using the same indenter across several dents.
- Examine the effects of neighboring stress distributions on the decoupled signal by having two dents next to one another.
- Examine the signal from un-rerounded dents that may be found in the pipe.

- Obtain signals from shallow dents that a caliper arm tool may have trouble detecting or characterizing.
- Examine the effect of a stress raiser created by a sharp edge.
- Examine the reproducibility of a decoupled signal by creating two dents that are identical in dent geometry and depth.

Sets of four pulls will be done at speeds of approximately 0.5, 1, 1.5 m/s and the maximum speed possible, which is about 1.7 m/s. The pull tests will be video taped and the force needed to perform the pulls will be measured in order to help determine the conditions necessary for an inspection to be done using the dual magnetization tool on a gas line in the future. The high and low field magnetizer segments are connected together and will be pulled as one, while the caliper arm segment will be pulled separately the week of November 12th.

The magnetic field for the low field segment has already been measured by pulling it separately through the Enbridge supplied pipe section and found to be within the specified range of 50-70 Oersted (4 - 5.6 kA/m) for speeds from 0.5 to 5 m/s for a wall thickness of 7.1 mm. This is the same wall thickness as three quarters of the length of the line that the tool will be run on. The field level for the high field segment will be measured during the current pull test.

Results and Conclusions

Figure 1 is a photograph of the completed and joined low and high field segments of the tool, Figure 2 is a photograph of the pull test assembly, and Figure 3 is a closer view of the dented pipe. A picture of the section of pipe for the pull test is in the previous quarterly report.

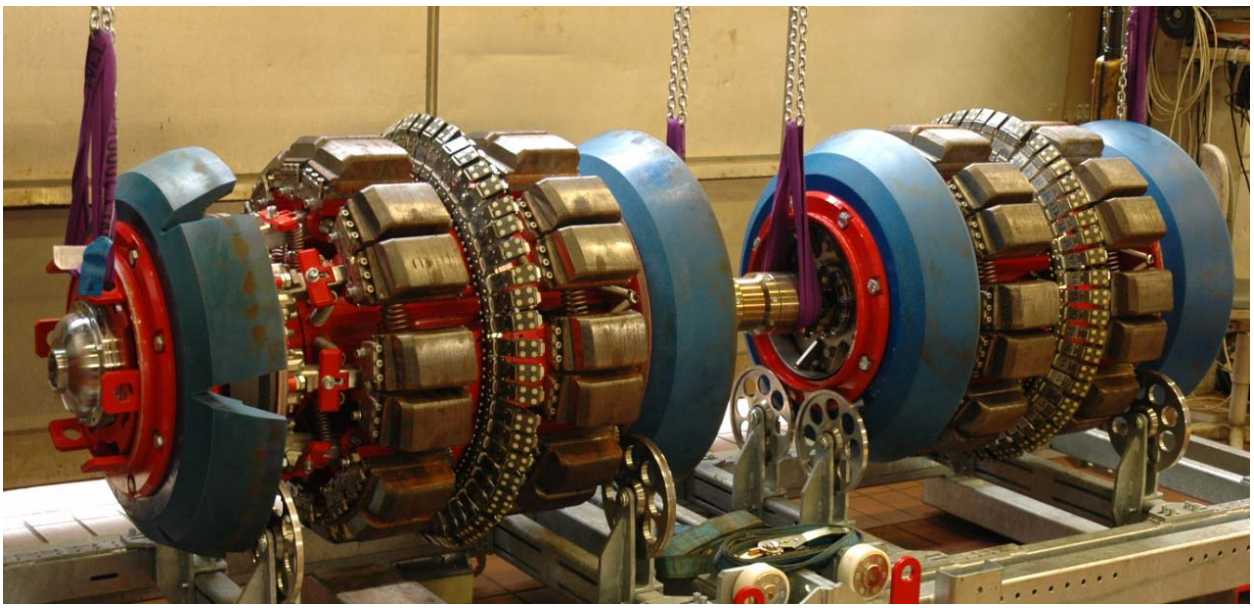

Figure 1: Complete high and low field magnetizer segments, connected together. The high field segment is at the front.

Figure 2: The pull test pipe assembly. The three meter long section of pipe in which a series of dents is surrounded by two five meter long sections of the same pipe in order to ensure that when the pipe wall surrounding a dent is magnetized each of the magnetizer poles will be on a section of wall with the same thickness and material properties.

Figure 5: A closer view of the dented section of pipe. A laser scan of the dent geometry was done by RTD for MD-1-2, and will be supplied to the MD-1-1 project.

Schedule

The project remains approximately 9 months behind schedule due to delays in the design and build of the tool. Technical progress is back on track and the project team is working to reduce the delays. The magnetizer pull tests will take place November 1st and 2nd, and the caliper arm pull tests will take place November 12th and 13th.

Plans for Future Activity

The team is currently planning to perform the run in mid December, barring any contingencies before then.

The presentation of the pull test results to the project team is tentatively scheduled for the beginning of December, and the run will take place shortly after the pull test results are presented.