Detecting, Locating and Mapping Internal Gas Pipeline Corrosion using Thermography and Photogrammetry

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Main Objective

This project was awarded to University of Nebraska-Lincoln in order to detect, locate, and map pipeline defects by using low-cost inline inspecting rover and multi-spectrum computer vision. The developed technology can be applied to both piggable and un-piggable pipelines of different sizes.

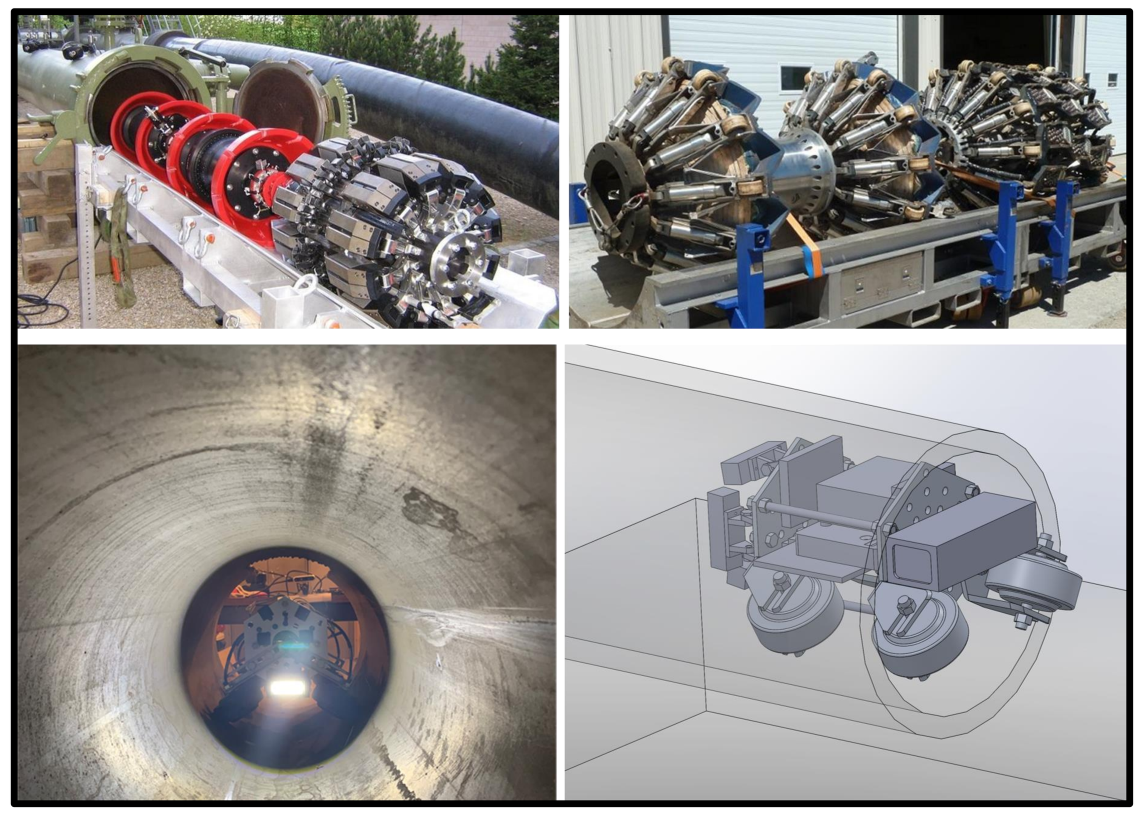

Figure 1. top: traditional pig, bottom: proposed inspecting technology

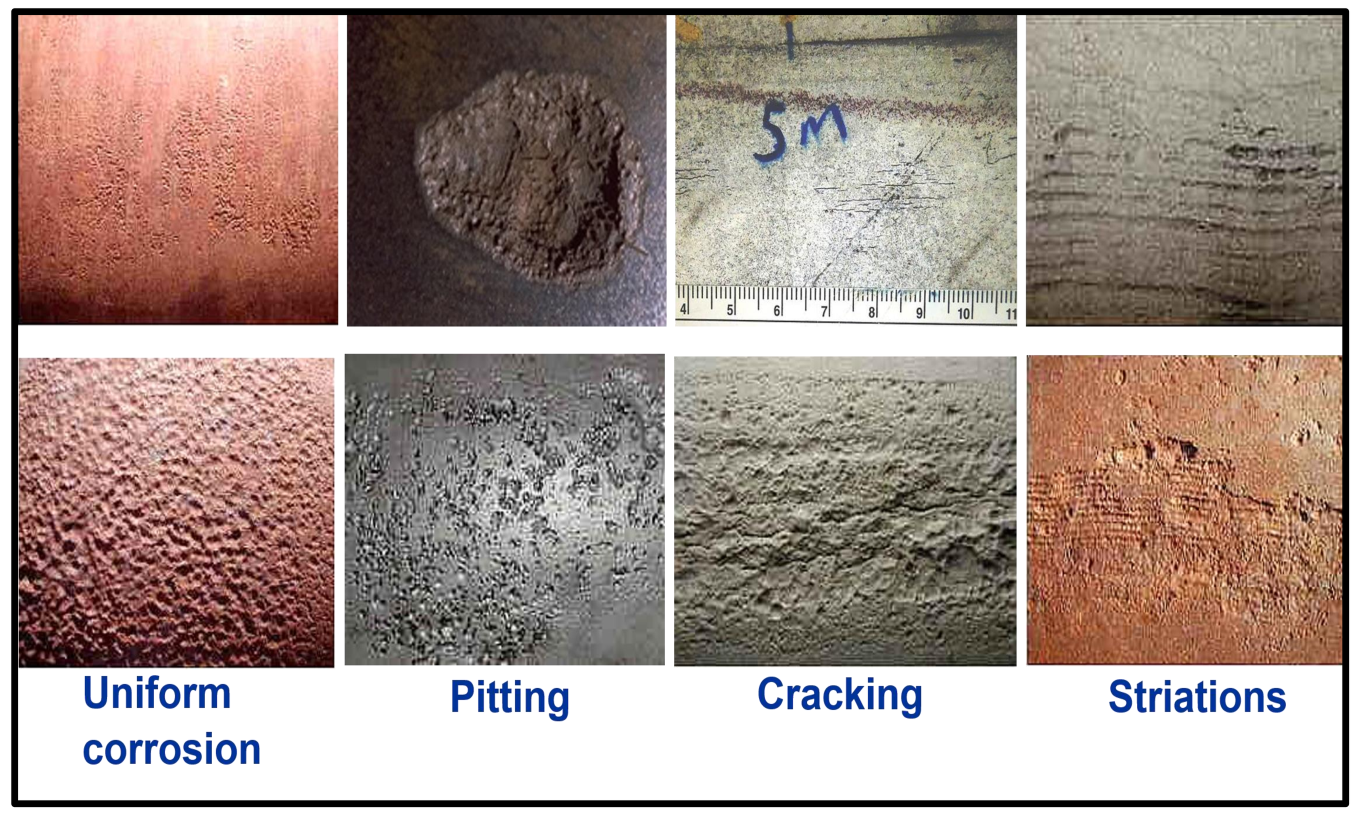

Figure 2. the target internal corrosions (images from internet)

Project Approach/Scope

- The primary research approach is experimental with a small portion of simulations. Testbed with slopes and turns was constructed to imitate the real-world inspection cases.
- The scope of work includes: (1) design and prototype the testbed and the inspecting rover systems; (2) design, test, and validate the detecting, locating and mapping algorithms; (3) field validations of the developed technology.

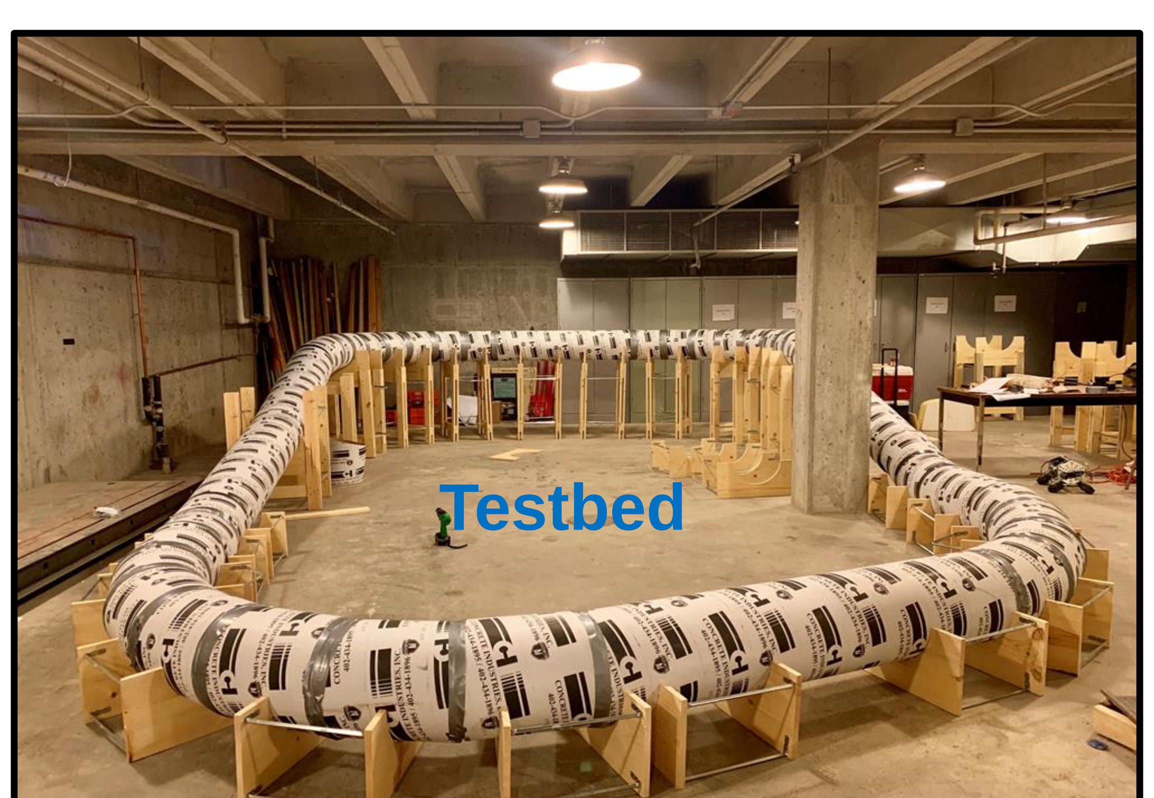

Figure 3. simulated pipeline plant with 14" diameter pipe.

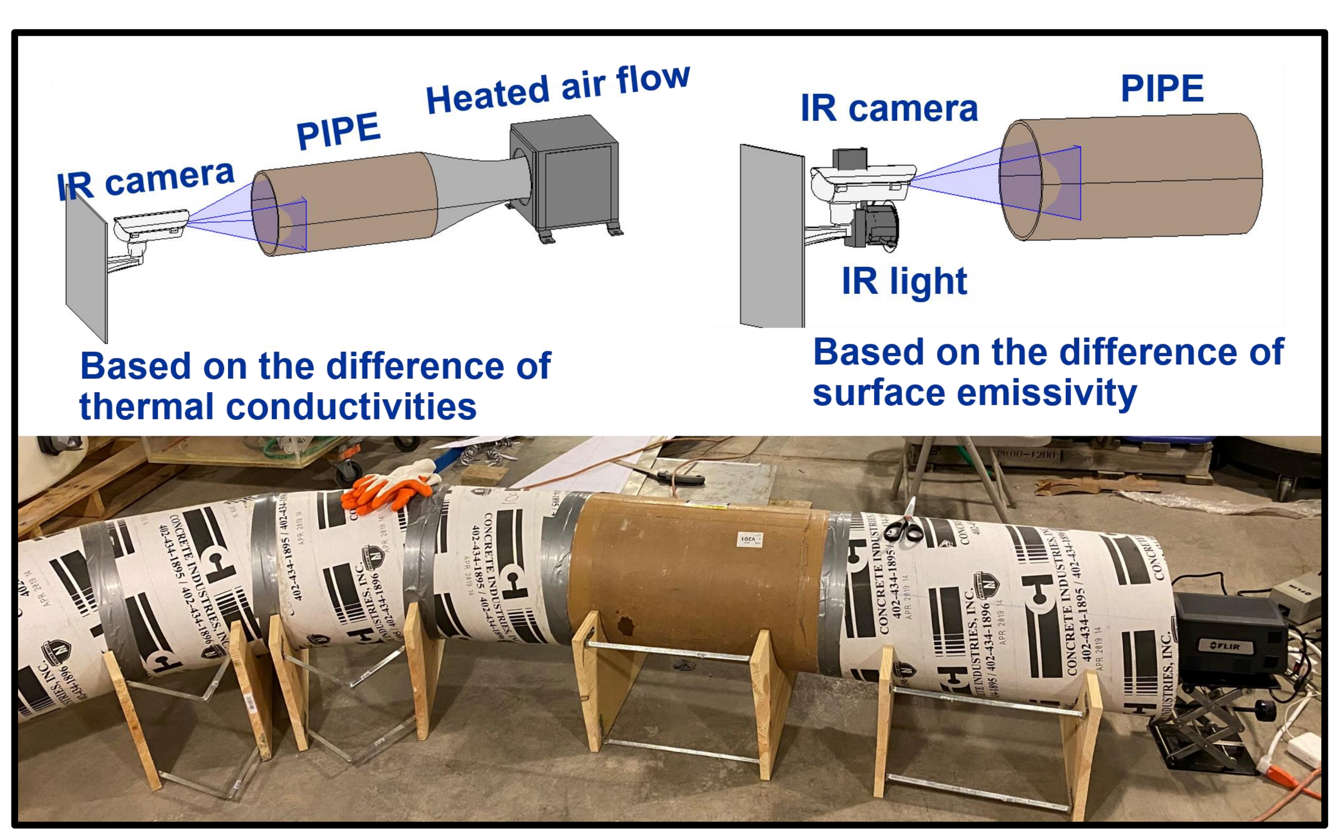

Figure 4. section of steel pipe for IR detection.

Results to Date

- Simultaneous localization and mapping (SLAM) algorithms were experimented to reconstruct the 3D pipeline model for locating and mapping defects. The outcomes is illustrated in Figure 5.
- Infrared thermography (IRT) results indicated that it can detect thermal irregularity features in low light pipe conditions with temperature gradient on the pipe wall.

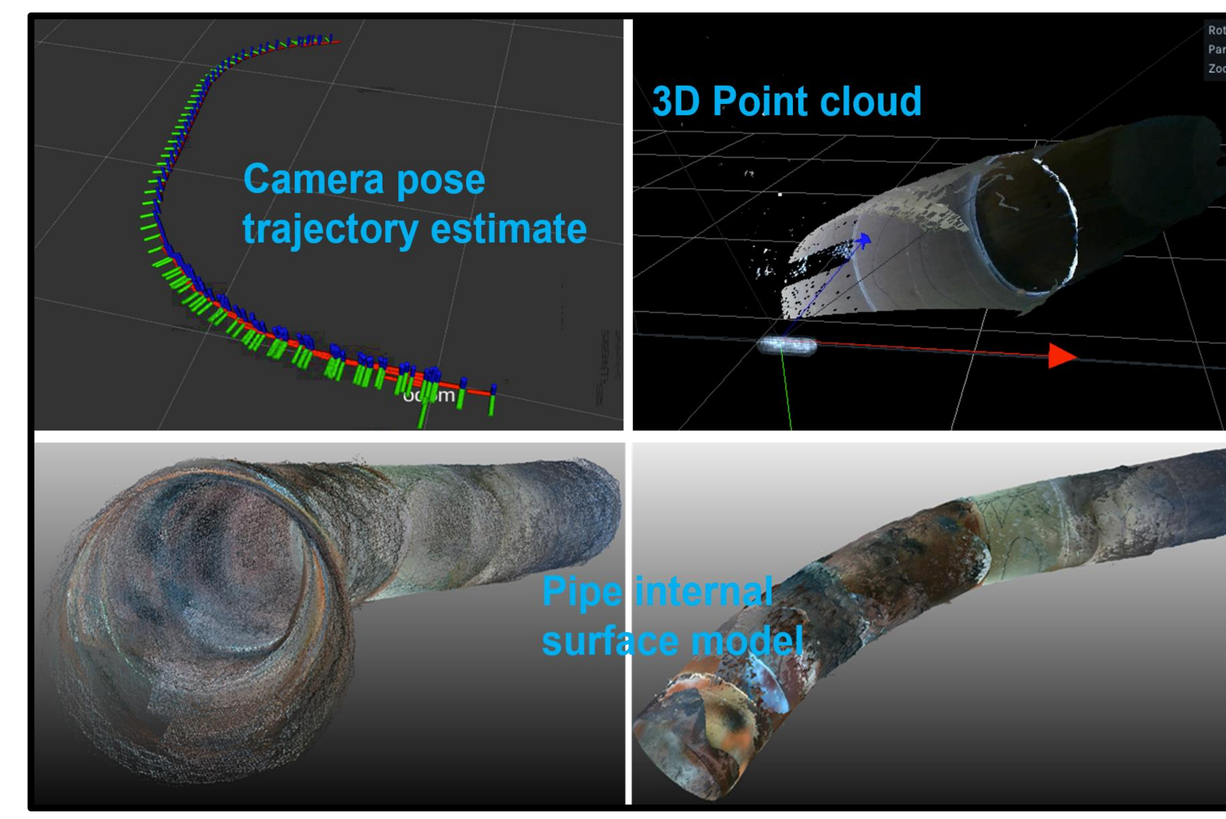

Figure 5. photogrammetry results of the rover on the testbed.

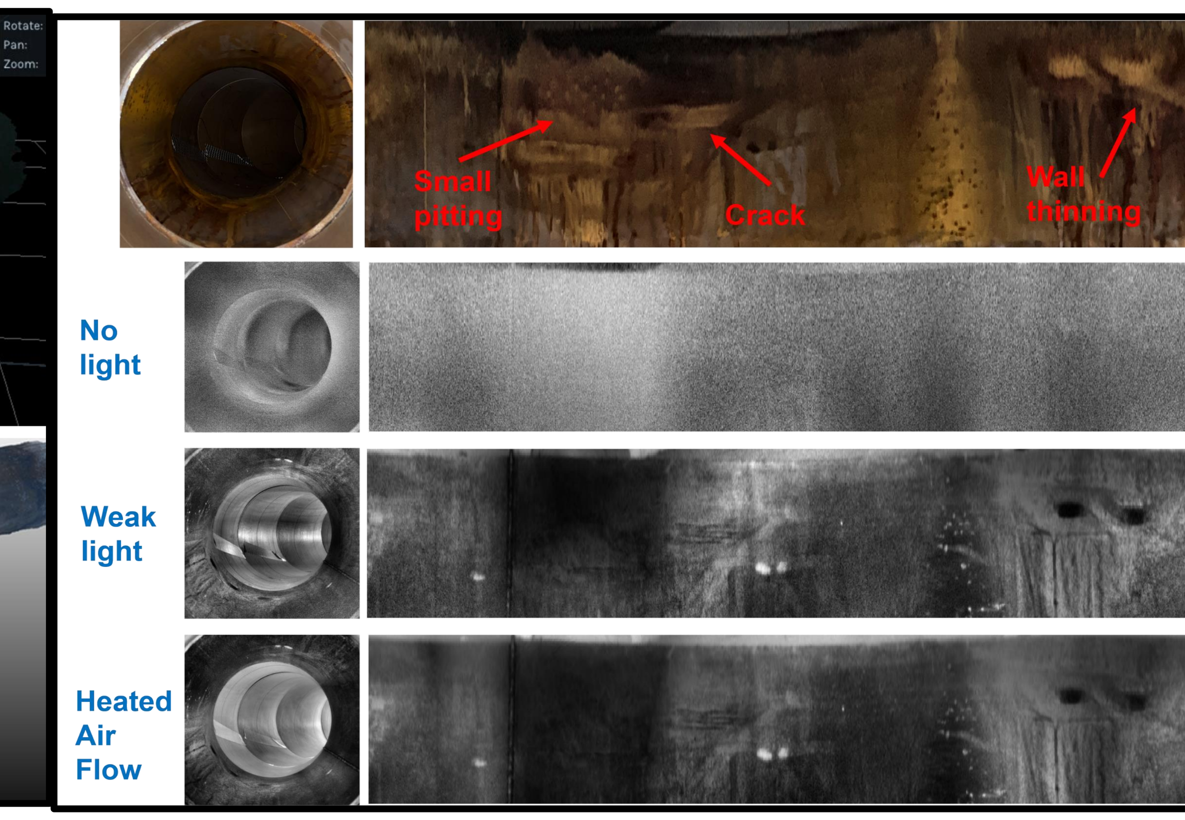

Figure 6. thermographic results under different conditions.

Acknowledgments

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