Enbridge Pipelines Inc. (Enbridge) is the main transporter of liquid hydrocarbons from western Canada to eastern Canada and the Midwestern United States. The underground pipeline system includes approximately 7,400 km of pipe, transporting approximately 280,000 m³ of crude natural gas liquids, and refined products each day. The maintenance of such extensive pipelines requires an efficient method of locating the position of pipe defects so they can be exposed and repaired.

Enbridge have used Trimble equipment to map pipe features such as timer box locations, and establish above ground control points. This created a reference datum for the In-Line Inspection (ILI) tool. An ILI tool is a testing device that runs continuously inside a flowing pipeline to inspect the interior wall of the pipe. The ILI tool is equipped with an Inertial Mapping Unit (IMU) which measures and records its location within the pipe. The positions of features such as welds, valves, and defects are determined by the ILI tool and the measurements from the IMU can then be referenced to the GPS reference datum. This results in a list of pipe defects. Back in the office these coordinates are used to generate waypoints for the pipe defects that are then loaded on to Trimble® GPS Pathfinder® Pro XRS receiver so the field crew can locate the problem sites.

Before using GPS, defects were located by a manual chaining method. This method used a feature in the pipeline such as a valve, and a distance measurement from the ILI tool, to give an approximate calculation of the above ground location. Locating a defect this way was inaccurate, labor intensive, and expensive—requiring two pipeline maintenance crew members to chain the site and usually several verification digs. Now, with the GPS Pathfinder Pro XRS system, Enbridge can accurately locate and map the underground pipeline features and defects. This means that when the ILI tool reports a defect, a crew member can easily navigate to the site, locate, and mark the position for the excavation crew.

**PROJECT HIGHLIGHTS**
- Maintenance of 7,400 km of pipe, transporting approximately 280,000 m³ of crude natural gas liquids, and refined products each day
- Ability to easily and accurately locate and map underground pipeline features and defects.
- System suitable to rough pipeline maintenance environment
- Return on investment via increased productivity, a reduction in costs, and less impact from excavations on the surrounding environment
The staff at Enbridge were given training on the theory behind GPS and the practical uses of the GPS Pathfinder Pro XRS receiver in the pipeline industry. They quickly became enthusiastic about the benefits of using the equipment as a part of their work. The size, portability, and robustness of the system make it suitable for working in the rough pipeline maintenance environment.

The use of the GPS Pathfinder Pro XRS receiver enabled Enbridge to gather reliable and precise data, cut down the number of staff required, increase the number of dig sites per day, and eliminate the need for verification digs—leading to increased productivity, a reduction in costs, and less impact from excavations on the surrounding environment.

During 1999, pipeline maintenance crews from Enbridge used the GPS Pathfinder Pro XRS receiver to accurately locate 190 excavation sites to within one meter—greatly improving the management and efficiency of their business.