Large Diameter Pipeline Case Study

WILLOWGLEN SYSTEMS INC.
Total SCADA Solutions

Introduction

Enbridge Pipelines Inc. operates the world's longest and most sophisticated crude oil and petroleum products pipeline system. The pipeline system is approximately 13,500 kilometers (8,500 miles) long and there are more than 530 active pumping units. More than 75 unique commodity types are transported, with service provided to more than 60 different shippers.

Willowglen has provided the custody transfer metering systems at key injection and delivery sites. The systems have the following features:

- Redundant flow calculation processors at key sites with time synchronization to 1 millisecond.
- Each processor pair is designed to handle up to 100 meters and 50 meter provers.
- Temperature, pressure, and meter factor corrections applied for each product type according to American Petroleum Institute (API) Standard 2540.

- Automated Meter Proving
- Data Trending
- Flow Splitting/Balancing
- Batch Detection and Processing
- Volume/Batch Comparison and Verification
- Meter Factor Management
- High Speed Pulse Accumulators
- Online Configuration
- Level “B” Security

Custody Transfer

Problem

Enbridge Pipelines Inc. required a number of systems which were capable of accurately metering various crude and product transmissions. These systems were to be located at various points along the pipeline. The metering of petroleum was done on a batch basis. The systems needed to be able to queue up several batches for transmission along the pipeline. Volume corrections needed to be performed based on batch composition, temperature, pressure, density and meter factor. Meter factors were to be dynamic, based on online meter proving which the systems monitored. Each system was required to be dual redundant, with the redundant computers synchronized to the millisecond.

Solution

Willowglen's dual redundant VISTA™-II Supervisory Control and Data Acquisition (SCADA) system was selected by Enbridge Pipelines as being the best choice available in the industry. The VISTA™-II system was based on Willowglen's Rack Mount Industrial Computer (RMIC) hardware which utilizes an industrial platform and can provide direct communication with Willowglen's Remote Terminal Units (RTU). The RTUs are responsible for monitoring the transducers on the pipeline.

The VISTA™-II system features include:

- Dual Redundant Custody Transfer System Accurate to the Millisecond
- High Speed Terminal Support
- Modbus Programmable Logic Controller (PLC) Communication Support
- Multiplexed Fiber-Optic Communication
- Automated Batch Processing

With the VISTA™-II system, Enbridge Pipelines has an easy to configure system with the following features:

- Online Configuration
- High Performance Real-Time Data Acquisition
- High Precision Batch Control Accurate to the Millisecond
- Dual Redundant Batch Comparison and Verification
- Automated Meter Proving
- Valve Control
- Sophisticated Volume Corrections Based on Product Type
- Capable of Monitoring up to 100 Meters

- Data Trending
- Programmable Acquisition and Control (PAC™) Programs

The VISTA™-II system can communicate with the PLCs for valve control and alarm monitoring. Communication with the Enbridge Pipelines' network is also supported so that system data can be transmitted into the corporate databases. At some of the sites, the RTU is over a 1000 feet away from the main systems. In these cases, Willowglen Fiber-Optic Communication Units are used to provide the required high speed and multiplexed communication link.

Measurement Information Data Gathering Interface

Problem

Enbridge Pipelines Inc. has a measurement system that handles the batch volume metering, meter proving, and volume corrections. The measurement system operates separately from Enbridge's main SCADA system and must be extremely accurate and reliable.

There was a need to upgrade the old measurement system at some of the terminals and to provide an operator interface for the gauger and operators. Some of the metering information must be sent to Enbridge's Supervisory Control and Data Acquisition (SCADA) system and Management Information System (MIS). Manual transfer methods have been used in the past and automatic transfer mechanisms are now required.

Solution

Willowglen Systems Inc. was selected to provide a SCADACOM® Measurement Information Data Gathering Interface (MIDGI) and updated Custody Transfer System (CTS). This system replaced the previous measurement hardware, provided a new, highly advanced user interface for the operators and automatically transfers measurement data to Enbridge's corporate Oracle® database.

The existing Custody Transfer Systems have been upgraded to Willowglen's Model 8016 Remote Terminal Units (RTU). The same high standards of redundancy, high precision batch control with millisecond accuracy, automated meter proving, valve control and volume corrections are provided with these high-powered RTUs. Several batches can be queued up for transmission along the pipeline. Volume corrections are performed on batch composition, temperature, pressure, density and meter factor. Meter factors are dynamic, based on the online meter proving which the system monitors.

Digi International Inc. PortServers® have been added so that the new 64-bit UNIX based host system can be used to acquire data from these RTUs over fibre optic and other customer supplied Local Area Network (LAN) extensions. The data then appears on the new user friendly multiple 24 inch diagonal wide monitor operator workstations. With concise, well organized, real-time data, the operators are able to quickly respond to system events, analyze the current state of the system and execute control actions. Data in the SCADACOM® MIDGI system's integrated Oracle® relational database is automatically transferred to Enbridge's corporate Oracle® database using the Enbridge corporate LAN.

Multi-Tiered Measurement and Electronic Ticketing System

Problem

Enbridge Pipelines Inc. has a measurement system that handles the batch volume metering, meter proving, and volume corrections. The measurement system operates separately from Enbridge's main SCADA system and is required to be extremely accurate and reliable.

Local and remote operator interfaces for the gauger and operators are required for each of the numerous metering sites. Electronic ticketing must be automatically performed at each metering site and this information must be transferred to Enbridge's Management Information System (MIS). Manual transfer methods have been used in the past and automatic transfer mechanisms are now required.

Solution

Willowglen Systems Inc. was selected to provide a SCADACOM® Measurement Information Data Gathering Interface (MIDGI) and to update the Custody Transfer System (CTS). The new system replaces previous measurement hardware and it automatically transfers measurement data to Enbridge's corporate Oracle® database. This is accomplished using a multi-tier approach that makes use of Enbridge's corporate Wide Area Network (WAN). Some of the metering sites are very remote and satellite links are required to connect the measurement equipment to Enbridge's corporate WAN.

The existing Custody Transfer Systems have been upgraded with Willowglen's dual redundant Model 8016 Remote Terminal Units (RTU) and Model 1208 Remote Terminal Units (RTU) and VISTA™-II host computers in a hot standby mode using Willowglen's SCANFLOW™ solution. Very high standards of redundancy, high precision batch control with millisecond accuracy, automated meter proving, valve control and volume corrections are provided. Several batches can be queued up for transmission along the pipeline. Volume corrections are performed based on batch composition, temperature, pressure, density and meter factor. Meter factors are dynamic and are based on the online meter proving that the SCANFLOW™ system also monitors and controls.

Digi International Inc. PortServers® have been added so that the new 64-bit SCADACOM® Tier 2 system can be used to acquire data from the SCANFLOW™ systems over Enbridge's corporate WAN. The data is available to Enbridge's Measurement Group administrators using the new SCADACOM® operator interface. With concise, well organized, real-time data, they can quickly analyze the current state of the system and execute control actions.

Relevant data in the SCADACOM® database is automatically transferred to Enbridge's Tier 1 corporate Oracle® database, again using Enbridge's corporate WAN.

(photo from Enbridge Inc.)