BIOGRAPHICAL INFORMATION

Grace Corsino
GIS Business Lead
TransCanada Pipe Lines Limited

Specific Responsibilities

Recently appointed as Project Controls Specialist, Grace is responsible for ensuring Project Protocols are in place for pipeline projects from proposal to execution phase.

Prior to taking on this new role, Grace was the Business Lead for the alignment sheet generator implementation project.

Past Experience

With over 15 years of experience in TransCanada, Grace is familiar with all aspects of the pipeline system design and operation across the TCPL system from Quebec to British Columbia.

Education

Professionally trained in project management, business management and Geographic Information Systems. Ms. Corsino holds a technology diploma from Mount Royal College.

Professional Memberships

GITA member

BIOGRAPHICAL INFORMATION

David Parker P.Eng MBA
General Manager
Colt Geomatic Solutions Ltd.

Specific Responsibilities

Responsible for general management of Colt Geomatics, Mr. Parker's team provides Geomatics consulting services to the North American energy industry.

Past Experience

David Parker has been involved in the hydrocarbon energy pipeline industry for 25 years.

With experience as an employee of Nova Gas Transmission Ltd. and TransCanada Pipe Lines Limited, he has managed the design and construction of large diameter, high-pressure natural gas pipelines. Additionally, Mr. Parker has managed information systems implementation projects in support of the gas pipeline business operation.

As an energy industry consultant with AMEC Engineering and now Colt Geomatic Solutions Ltd., Mr. Parker is focused on leveraging technology to provide value for operating companies in the oil patch.

Education

Bachelor of Engineering (Civil) – Carleton University, Ottawa Canada, 1980
Master of Business Administration (MBA) – University of Calgary, 2002

Professional Memberships

Professional Engineer - Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)

American Society of Mechanical Engineers (ASME) - member

LEVERAGING SPATIAL SOFTWARE IMPLEMENTATION TO ACHIEVE QA/QC ON PIPELINE OPERATING AND MAINTENANCE DATA

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ABSTRACT

TransCanada Pipe Lines Limited operates natural gas pipelines from coast to coast in Canada and is expanding its operations into the United States. The network of about 41,000 kilometers (25,000 miles) of pipeline transports most of Western Canada's natural gas production to the fastest growing markets in Canada and the United States.

Ensuring such a system operates safely and efficiently depends on access to accurate information. TransCanada is a leader in the implementation of productivity tools for managing and leveraging pipeline spatial information. The result has been reduced costs and improved safety of the pipeline operation.

This paper will highlight the lessons learned by TransCanada over the course of two implementations of Alignment Sheet Generation software and the associated database structures. Value created for the operations and maintenance of the pipeline business will be highlighted. Key to the implementation of spatial information systems has been an ongoing dedication to improve data integrity.

BACKGROUND OF THE BUSINESS ENVIRONMENT

TransCanada owns and operates one of the largest, remote-controlled natural gas pipeline networks in the world. With more than 41,000-kilometres (25,000-miles) the pipeline system links the rich natural gas resources of the Western Canada Sedimentary Basin - one of North America's largest, most cost-competitive sources of natural gas - to markets across Canada and the United States.

TransCanada System

- ?? 41,000km of wholly owned pipeline; transporting 11.5 Bcf/day
- ?? Ranging in diameter from NPS 4 through NPS 48
- ?? Ranging in MAOP (Maximum Allowable Operating Pressure) from 6520MPa to 9930MPa (950psi to 1,440psi)

Regulatory Requirements

TransCanada operates pipelines in a number of regulatory environments. In Canada, the two main government agencies that TransCanada is regulated by are the National Energy Board (NEB) for inter-provincial pipelines and the Alberta Energy & Utilities Board (AEUB) for intra-Alberta pipelines. The NEB is an agency of the Canadian Federal Government and the AEUB is a quasi-judicial agency of the Provincial Government of Alberta.

The role of these regulators is to determine the economic, technical and financial feasibility of a new pipeline construction project. The regulators also consider the environmental and socio-economic impact of such a project. These regulators are also responsible for determining whether or not pipelines are being operated in accordance with engineering, safety and environmental requirements. The NEB shares responsibility for incident investigation with the Transportation Safety Board. The NEB also monitors excavation by third parties near pipelines to ensure compliance with regulations.[1] The NEB regulates over 10,000 km of TransCanada's natural gas trunk lines.

Alberta is Canada's most energy-rich province. Within the borders of Alberta, over 250,000 km (155,000 miles) of energy pipelines are regulated by the AEUB. TransCanada operates over 23,000 km of natural gas transportation pipelines within Alberta.

TransCanada works closely with the regulatory bodies to ensure safe operation of the pipeline network. Key regulatory compliance reporting requirements include:

- ?? Risk analysis for structure encroachment on High Consequence Areas
- ?? Pipeline integrity inline inspection reporting
- ?? Area Class Location review and upgrade programs
- ?? One call updates

In order to provide accurate, timely information to satisfy regulatory compliance reporting requirements, TransCanada has implemented an automated digital information storage and retrieval system. This complex information systems environment enables TransCanada to track the status of its pipeline assets, integrity maintenance activities and the impact of external third parties upon the TransCanada system.

Pipe Engineering

In order to operate the natural gas pipeline system safely and efficiently, TransCanada has designated responsibility for integrity management to the Pipe Engineering group. Within Pipe Engineering, two teams share the responsibility of planning and executing the various activities needed to ensure maintenance activities are carried out.

The Program Development group is responsible for developing integrity management programs. Program Development gathers and maintains the pipeline data essential to ongoing pipeline integrity. This team has accountability for using spatial data to design work programs that will keep the pipeline operating within regulatory requirements and available to meet customers' natural gas shipping contracts.

Program Implementation is responsible to implement pipeline remediation and repair programs. Overseeing the construction activities, Program Implementation takes information from Program Development and in turn feeds back field "as-found" data to the spatial databases for further planning and analysis activities in the future.

Spatial Data Systems

TransCanada has structured an information systems environment to track pipeline information with spatial reference for all attributes. The main component of this system is the geographically referenced relational database. The Orion database was implemented on the Oracle platform. Orion is based on the industry standard ISAT (Integrated Spatial Analysis Techniques) pipeline database schema.

Several ancillary systems are implemented to facilitate updating and loading of information in the Orion database. Key to the update of pipeline spatial data is a tool called FDM (Facilities Data Manager). FDM enables TransCanada to enter as-built pipeline information into the Orion database.

On the output side of the Orion database, TransCanada has implemented a tool called GeoFind. GeoFind is a general-purpose web application that provides a map based user interface for viewing, navigating, querying and analyzing TransCanada data. Access to the application is driven by profiles. Selecting a certain profile determines which data is available to be displayed on the map and which functions (e.g. search functions, tools, etc.) are available on the drop down menus. Not all users have access to all profiles.

Examples of GeoFind profiles include:

?? General – basic data and functionality available to all users
?? Hydraulic – access to hydraulic based data and functionality as required for feeding the simulation tools
?? Cathodic Protection – provides access to CP related data such as anodes, ground beds, test stations, etc… as well as access to the CP measurement graphing tool
?? Site Remediation - provides access to environmental site remediation data
?? Vegetation - provides access to vegetation data and the Vegetation Management application

Facilities data can be viewed in conjunction with other spatial information such as township grids, cities, building locations, and even satellite and aerial imagery. Facilities data can also be queried, with the results shown in a table, exported to Excel, or displayed in a map. The map is interactive, showing "tooltip" information when the mouse pointer is moved over an item on the map. Much of the map information is also clickable, displaying information about the item on the map that was clicked. FileNet links within the system enable the user to view or search documents in the Electronic Document Management System that are related to facilities.

A project to implement an As-Built Alignment Sheet Generator (ASG) was initiated.

Over 75% of As-Built alignment sheets using CAD technology were out of date. FileNET was to provide images and base maps in a geospatial environment to plot the pipeline data. FileNET was used to store the ASG alignment sheets for distribution to the user community. Web based functionality was to enable any user with a network connection to TransCanada to generate ad-hoc As-Built alignment sheets, thus reducing the requirement for Pipe Engineering to generate static as-built alignment sheets. The concept of a dynamic alignment sheet was to provide timely and cost effective access to pipeline as-built information as opposed to static alignment sheet that relies on CAD based technology to generate and distribute as-built data.

The ASG Project consisted of using a combination of database and CAD technology to automate the process of generating a pipeline alignment sheet for as-built record keeping. The ASG solution communicated with the facilities database Orion and the document management database FileNET. Using AutoCAD Map 2000i and FDM technology, the project created reports from Orion and FileNET in the format of a pipeline as-built alignment sheet.

CHALLENGES AND OPPORTUNITY

TransCanada's objective was to implement a tool that matched business requirements set out by the users of the pipeline data within the Engineering Department. TransCanada contracted a third party software developer for its ASG. For the developer, this meant extensive customization of their product to match the required deliverables. As each phase was completed, it became clear that the need for a more flexible tool was required. The software was implemented, but was lacking in functionality that required further enhancements and work around steps using manual CAD operations for each alignment sheet created.

Over the course of several iterations of software enhancements, it was concluded that the end product that TransCanada required was not going to be achievable with the software initially chosen.

The continuous need to make small changes with the software code was not acceptable. Issues included:

- ?? TransCanada had to go to the vendor every time a small change was required.
- ?? Cost of software modifications had a noticeably increased.
- ?? There was still the requirement of manual CAD touch ups for an acceptable alignment sheet.
- ?? The TransCanada ASG team was also faced with diminishing resources and staff turnover in its internal Information Technology (IT) group, which affected continuity of support.

After several years of marginal success with this software, TransCanada elected to implement a new reporting system for alignment sheet generation. A cost benefit analysis was created to show comparison between the following alternatives.

- ?? Creating alignment sheets with the initial ASG software tool and the associated manual work around interventions.
- ?? Proceeding with further software enhancements to the initial ASG tool.
- ?? An alternative solution of upgrading the reporting tool by using new Alignment Sheet Generator software.

It was decided to proceed with the implementation of new software, and Colt Geomatics recommended implementing Blue Sky Solution ASG software. TransCanada accepted this recommendation.

THE SOLUTION

Pipeline data was stored in a modified ISAT data model. With the structure of the database in place, and data elements populated, Colt Geomatics proposed implementing a new tool for reading the database and creating alignment sheets. The tool would use the existing data structure and would reproduce TransCanada alignment sheets as they were currently produced without manual after-work.

Colt Geomatics suggested implementation of the Blue Sky AlignDB tools as a user-configurable, out-of-the-box approach to alignment sheet generation. The Blue Sky AlignDB product was selected for its compatibility with a number of industry standard data models and for its "configurability" out of the box. The software offered the flexibility to be able to build additional alignment templates (i.e. construction, environmental, cathodic protection).

The key implementation challenge was that output had to match the existing TransCanada alignment sheets. At the same time, the objective was to use the Blue Sky tools "out-of-the-box" without modification. It became apparent that these objectives were conflicting to some degree.

The solution was to balance the TransCanada alignment sheet configuration standards and the enhancement of Blue Sky tools. After some additional effort, the result was delivered to the satisfaction of TransCanada.

In order to achieve the success of this solution, it was necessary to have continuous support, commitment, and acceptance to change. All of these factors were present in each of the three corporate entities involved in the project.

TransCanada is now using their GeoAlign system to generate as-built alignment sheets from the Orion database. At the time of writing, 5,000km of pipeline alignment sheets have been produced using the GeoAlign system. Currently, the implementation of the tools within the TransCanada environment is being completed.

The QA/QC validation step included producing alignment sheets with the new Alignment Sheet Generator from data in the Orion database and then comparing the automated alignment sheets to the legacy hand drawn and CAD produced sheets. Discrepancies between the information in the database were highlighted and corrections were bulk uploaded to the Orion database.

RESULTS

TransCanada has gained the ability to rapidly verify the accuracy of data held in its spatial pipeline database. Comparing alignment sheets produced automatically from the Orion database against archived CAD or manual as-built alignment sheets enable rapid and accurate identification of differences. The marked up automatic alignment sheets are then entered into a bulk data load tool to update the Orion database. Final as-built

alignment sheets are stored in the FileNet environment so that company employees can access the drawings from any location.

LESSONS LEARNED

In a software implementation case, it is important to understand the business requirements at the outset of the project. If the software tool is expected to produce deliverables that are tailored to the companies existing products, then additional programming effort will be required. If the tool is going to used "out-of-the-box" then the business requirements are going to be modified.

Within the TransCanada business operation, it became clear that several individuals were involved in guiding the course of the work. In order to ensure clear, consistent approach such a project should always have a single point of contact (SPOC) on the business side.

Relationships where support is provided by service providers that have strong content knowledge of the client's business needs enables a good compromise solution to be achieved where the combination of business requirements and "out-of-the-box" functionality are possible.

Choosing the right combination of software provider and solution implementer is key. Using the right service provider in the right role achieved the best possible outcome. The solution implementer must understand that its role is to assemble solutions and datasets to leverage the value of spatial datasets. They need to know how the information is used and what business problems are being solved. The software provider must understand the software development and implementation of alignment sheet generators. They should bring a broad understanding of the market place.

FUTURE DIRECTION

TransCanada, based on the findings of the 5,000km pilot, is considering completion of QA/QC on the remaining 35,000km of pipeline. Depending on the cost of updates required to the Orion database, TransCanada will make a decision to either manage data inaccuracies or to spend the effort required to bring the database into line with the actual historical information.

In addition to the pipeline integrity business applications, use of the spatial data and related software is being used for new construction projects, including design deliverables and project controls.

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[1] www.neb.gc.ca