Mapping Northeast Utilities' Underground Network

It's difficult to appreciate the danger and frustration that underground workers face in their daily tasks. Imagine going to work in the middle of the street where you need cones and a barrier for protection, and maybe even a policeman: where you need to test the manhole cover for stray voltage and the air for dangerous gases. When you open the cover and look down, you may see oil floating on water in which case you may have to call in the pump and clean truck. The lab results of the sludge may come back with lead contamination. Then when you enter the confined space, about the size of a large bathroom, you hear the hum of transformers and see primary circuits racked along the walls. While checking the arc proofing, you notice that rats have eaten away at it for nest material.

Now imagine this is your work place and you need to work there five days a week.

Northeast Utilities (NU) realized that this situation could be improved upon by providing underground workers with accurate Data such as inspection information, manhole dimensions, primary and secondary cable details (stock codes, sizes, materials coatings, asbestos arc proofing).

Gathering Underground Network Requirements

In order to develop a more efficient manner in which to maintain an underground system, 45 underground workers, from every branch of the Company (Dispatch, OMS, System Projects, GIS, IT etc) came together at an Underground Work-shop in mid-September of 2004.

After discussing experiences and exchanging ideas, the following major challenges were identified:

- Consolidate fragmented data from multiple sources and districts, each with their own home-grown methods.
- Adopt a single, centralized data repository from which all business units could work.
- Provide underground workers with up-to-date information in an effort to improve working

conditions.

- Reduce manhole inspection and maintenance costs through optimization.
- Increase landbase accuracy by providing GPS locations of structures on geo-referenced maps. Without geo-referenced locations, important facilities, such as manholes may not be found when paved over.
- Reduce outage lag-time by creating per written switching orders.

In all, over sixty improvements were approved. Everyone agreed that the points identified at the Work-shop were indeed necessary to better maintain an underground network. But how could these goals be achieved with a paper-based mapping system?

Some of the maps were drawn using ink on mylar, some were drawn in AutoCAD, but lacked electrical connectivity and attribution such as elbows on transformers, phasing. Some of the maps were over a hundred years old, and since they were drawn by many different electric companies (that later merged), they had not yet established a corporate mapping standard.

Through a competitive Request for Proposal process, JCMB was selected to provide NU with an AutoCAD-based, software solution for maintaining the Direct Buried/Underground (DB/UG) network. With minimal base-product enhancements, JCMB's off-the-shelf Automated Mapping tool (Adele) met all of NU's DB/UG mapping requirements.

JCMB Assists NU in meeting their Mapping Challenges

The DB/UG team met with GIS Technicians from all over Connecticut for a two-week period. During this time, they focused on the business requirements for each unit and in-turn, wrote their specifications. The goal is to provide the best underground model possible. After this project is completed, all maps will be standardized with complete data attribution, electrical connectivity and accurate scaled landbase. Conductors will have proper line types. Switches, cutouts, elbows etc. will have proper symbology with visual representations (green for open and red for closed).

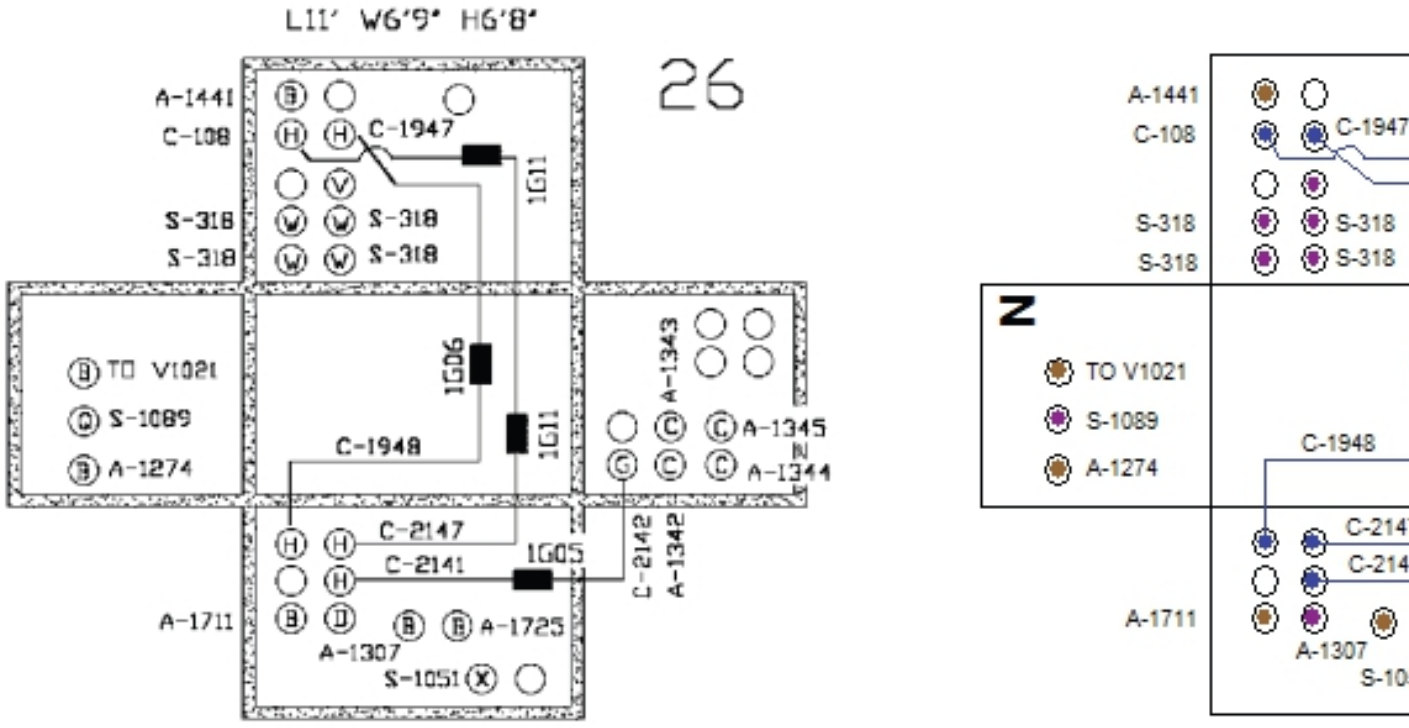
The plan is to constantly maintain the maps and internal worlds on a four-year underground and a five-year direct buried inspection cycle. This means that the maps will never be more than four and five years out-of-date (including the as-built changes from the field). Ultimately the digital maps will help implement a work-bundling approach that will reduce costs and increase efficiency.

To be truly effective, a utility's Data Model needs to reflect these actual field conditions in order to run the business efficiently. One way to improve Data Integrity is to field-validate the Data. In the field, an underground worker can do the electronic manhole inspection, and at the same time, take digital pictures of the walls and duct layouts. Once the Data is entered, the inspection information as well as width, length and height of the structure are usable by other systems. Direct buried and underground (DB/UG) tools manage field Data like manhole dimensions in order to create precision scaled underground structure layouts (internal worlds) for maps.

Modeling irregular manholes and customer vaults was another challenge that NU faced. JCMB fused two technologies: CAD and GIS, and developed a Structure Feature Editor. This tool has the capabilities of drawing a room with doors, shelves, windows, vents, columns etc. The results are a real-world vault layout drawn to scale, which on a map, looks as simple as a GIS symbol. This facilitates the modeling of complex switches as well as the entire variety of PMH switches.

These complex devices allow the mapper to interactively manipulate the symbology so that it will mimic the mechanical operations of actual switches, throwing away the GIS "cookie cutter" approach.

Figure 1 – Before and After - Internal-View of Vault



Putting a Working Process in Place

Taking into consideration the magnitude of the project (over 17,000 Direct Buried and Underground maps), it was necessary to implement a process, in order to work as efficiently as possible—a way to exchange data between NU and JCMB.

Process

- The DB/UG Team scrubs the information (such as drawing scales, street names, postal abbreviations, circuits, voltage, phases) on the old maps.
- The data sources and electronic tiff images of the old ink maps are sent to JCMB.
- JCMB's Conversion staff recreates new, accurate and intelligent maps.
- Once the data is returned to NU, the DB/UG QA team completes any outstanding work orders, DB inspections, cable cures, field checks and implements standard structure numbering etc.

To read the entire story, select the article Mapping Northeast Utilities - news flash