# BIOGRAPHICAL INFORMATION

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## Specific Experience

Peter works in the EPCOR Information Technology branch and his team is responsible for the development and support of EPCOR's CAD and GIS systems. His team provides support and direction for the EPCOR Infrastructure Division, which consists of Water Services, Distribution and Transmission and Generation. The team consists of six full time members and three contractors.

## Past Experience

Peter joined EPCOR (formerly Edmonton Power) in 1980 and developed the Power AM/FM recording system. When Water Services joined EPCOR, Peter's team also took over the support of their GIS and CAD systems.

## Professional Memberships

GeoSpatial Information Technology Association
Bentley MicroStation Community

# GeoEngineering in a Mobile Environment

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## ABSTRACT

This paper highlights EPCOR's success in eliminating paper record plans in the field by merging Mobile Computing and Geographical Information System technologies. **EPCOR Utilities Inc.** is one of Canada's top providers of energy and energy-related services and products. Drawing on over 100 years of experience, EPCOR owns and operates power plants, electrical transmission and distribution networks, builds and operates water and wastewater treatment facilities and infrastructure and provides power and water solutions to customers in Alberta, British Columbia, Ontario and the U.S. Pacific Northwest. With $4.5 billion in assets, EPCOR is headquartered in Edmonton, Alberta. EPCOR's web-site is www.epcor.ca. Approximate 300.000 of EPCOR's Edmonton customers are supported by the mobile GIS solution. GeoEngineering Access is a tool, developed in-house, that provides access to detailed power, water and other utility data, city wide, in a variety of formats integrated with a Global Positioning System. The organization's daily operations and customer service areas have achieved significant timesavings and cost benefits. This paper describes mobile computing and GIS database capabilities as well as the information sources accessed using this innovative and cost-effective system over the last 6 years.

## BACKGROUND INFORMATION

When this tool was developed, the company name was Edmonton Power. In 1999 it was decided to rename Edmonton Power, EPCOR. EPCOR is now a large company containing many business units, including power and water, owned by a single shareholder that is the City of Edmonton. For the purposes of this paper EPCOR and Edmonton Power are used interchangeably.

## HISTORY OF GIS USE WITHIN EPCOR

Edmonton Power became involved in the Corporate Geographic Base Information System project along with the City of Edmonton and the Province of Alberta in 1977. The program benefited from the map standardization efforts initiated by the provincial government of Alberta. In 1981 Edmonton Power purchased an Intergraph PDP 11/70 and developed their own GIS recording system. Edmonton Power began the process of

recording and maintaining all of our electrical facility locations and information in 1981 and completed our initial input by late 1985.

## GIS DATA SHARING WITH EDMONTON SPATIAL PARTNERS

The City of Edmonton has a very accurate basemap, which is controlled by the Government. All the utilities and city departments share the basemap. MicroStation files containing spatial data such as Drainage, Assessment, Gas, Cable, Assessment, Registered Plans, Telephone, Traffic, Streetlight, Trolley, Water and Power are exchanged on a daily basis. These spatial files cover the same geographic area and are compatible with each other, which allows for easy integration. This strategy has proven to be very successful for the city.

## EPCOR'S MOBILE GIS COMPUTING HISTORY

Over the years we've experimented in many ways with mobile computing, but the cost was always too high and the technology was not yet developed enough. Our first success was in 1995 when we wrote a utility search program running on top of MicroStation Review, for a cable locate company in the City of Edmonton. This utility search program allowed for quick and seamless access for all utilities. 20 trucks were equipped with desktop 486/100 PC's. The trucks received monthly system updates by CD. This proved that Mobile GeoEngineering could vastly improve efficiency in the field.

Edmonton Power office staff had the ability to access and manipulate their GeoEngineering information with the MicroStation software, however field workers didn't have access to the digital data while working in the field. They continued to rely on around 12,000 prints, to perform their routine work. In 1997 Edmonton Power began a pilot project. Our goal was to come up with an affordable, easy to use mobile data access system using suitable hardware. The solution was to create a program, which we called GeoEngineering Access. For hardware, laptops were an obvious first choice, but the price of about $8,000 was too high and it was decided to try using desktops in the trucks.

## MOBILE PILOT PROJECT

The pilot project began with 2 field units installed in cube vans. We chose

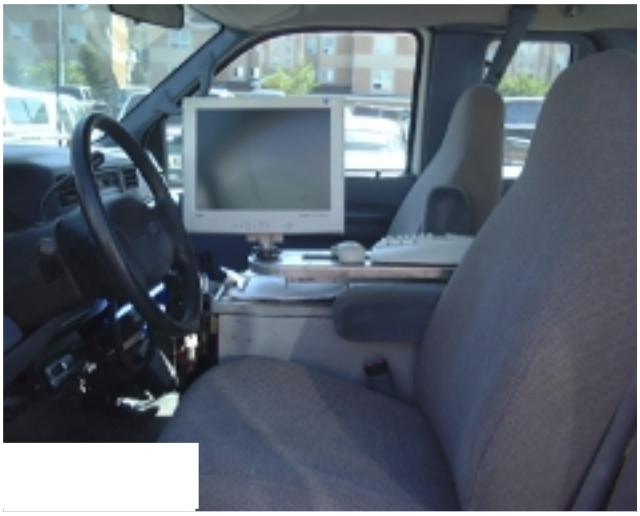
Pentium 166 computers, using a Dbase database, GPS, power converters and 17" monitors which provided a much better viewing area then a laptop. All this was purchased for one third the price of a standard laptop. As well, our experience has proven that repair costs of laptops are much higher than component based desktops. One other advantage of using desktop computers was that in case of project failure the desktops could be used in the office.

The GPS is used to dynamically display the utility data based on the vehicle location. When the truck stops, all the geographical data is displayed based on the current location. Figure 2 shows the computer and printer stored in a cabinet of a cube van. Figure 3 shows the monitor, keyboard and mouse configuration in a cube van.

Input from field staff was sought during the designing of the GeoEngineering Access system. They needed access to data in a timely manner. On trouble calls decisions have to be made quickly and access to underground information is vital. Information Technology staff spent a significant amount of time in the field with the pilot participants to gather system requirements. This was a very important step in the design of the system.

## MOBILE GIS IN PRODUCTION

The pilot project was a success and in 1998 GeoEngineering Access went into production with 16 trucks fully equipped with the following hardware and software: A Pentium II 300 MHz computer running Windows 95, with 32 Mbytes of RAM and a 6.4 GByte hard drive, a 17" NEC monitor, an HP Paintjet, a Trimble Navigation GPS receiver, Personal Oracle, MicroStation GeoOutlook and a network card for data synchronization. A 12 to 120-Volt power inverter provided power. Over the years the systems have been upgraded as part of EPCOR's evergreening project and the old truck systems were re-deployed in the office.



In August 2000 Water Services was added to the mobile GIS project. The EPCOR Mobile GIS system is now running in 50 vehicles of various configurations such as: cube van, van, crew cab and club cab. More recently the mice and keyboards were replaced with wireless devices, which allowed for additional flexibility. In the truck cab configurations, a custom manufactured sliding tray was installed, which allows the LCD

panel, keyboard and mouse to be moved to the back while traveling as shown in figures 4 & 5.

When this project was started we envisioned a more efficient guide for the field staff. It has turned out to be an indispensable tool for them. Bill Friedrich is an underground cable lineman and was one of the participants of the pilot project. He knew that the system would have many benefits for the field staff, Friedrich recalls one in particular*: One night about 2:00 a.m. we were working on scheduled maintenance (outage to a business customer) when we saw flames above the rooftops about one kilometer away. We drove to the flames, falling in line with fire trucks and other emergency vehicles. As we arrived at the scene, we immediately hit the GPS position button and the relevant map appeared on screen. When asked by the fire captain to quickly disconnect power to the house on fire, nothing more than a glance at the screen identified the most accessible location from which to disconnect the power source.* Field staff have been key to the success of this project. Their input during the design was carefully considered. Even though it was hard to find volunteers for the pilot project, once they saw the benefits of the system they were eager to try it. Now, they demonstrate a sense of ownership of the data and they willingly rely on it as their only source of data to operate EPCOR's utility systems. With the vast amount of geospacial data available, field workers continue to find new and innovative ways to use it.

Since the start of the Mobile GIS project, system failures have been in line with the system failures experienced in the office environment. Over the years we have replaced a few hard drives and we re-image about 10 systems per year. Each yard has a spare system, which is used to swap with problem systems. Last year, one of the Water trucks was involved in a collision, which resulted in major damage to the vehicle. During extraction of the Water staff member, the emergency personnel cut the wires to the computer and tossed it aside. The computer was refurbished with new wiring and is now in production again. This shows the durability of this equipment.

Data replication is initiated by the user while connecting the computer to the LAN by means of a docking port. There are yard docking ports and garage docking ports. Figure 6 shows a yard docking port, which is used by the 24/7 trouble trucks. Two replication options are available; immediate and

delayed. Delayed replication happens after 2:00 AM in the morning when the demand of the network traffic is low.

## DATA ACCESSIBLE IN THE MOBILE ENVIRONMENT

The GeoEngineering Access application was created to access many geospatial datasets and is an integrated product capable of performing enhanced database access, and field operation tasks. The application's features enables users to locate geographical areas, identify citywide utility systems and company operated power facilities, obtain detailed geographical and non-geographical design drawings, acquire graphical and non-graphical facility information, and interactively manage the viewing windows, displaying different kinds of drawing and facility information. Users can execute both standardized and customized functions permitting them to use customized tools for locating and viewing facility details, managing independent viewing windows, and manipulating power, water and utility display options. The application gives the users access to the following data and tools:

| **Utility** | **Access method** |
|---|---|
| Basemap, power, water, telephone, gas, drainage, traffic, streetlight, trolley, assessment, registered plans, aerial photos, Customer application numbers | Multi view seamless access to the tiled files |
| **Power** | |
| Engineering design proposals | By selecting the proposal shape |
| Circuit plans | By selecting a circuit facility |
| Schematics | By selecting a schematic facility |
| Manhole drawings | By selecting the manhole |
| Customer drawings | By selecting the customer symbol |
| **Water** | |
| Engineering design proposals | By selecting the proposal shape |
| Valve inspection sheets | By selecting the valve |
| Hydrant inspection sheets | By selecting the hydrant |
| **Common** | |
| Database attributes | By selecting a feature containing database information |
| **Miscellaneous tools** | **Purpose** |
| Water main break isolation | After selection the break in the main it will list which valves to close to isolate the main |
| Display manager | Allows the users to resymbolize the geospatial features to any color, style, scale or weight |
| Lookup by Address, intersections, cadastral, facility device id's | Centres display based on input |

## CONCLUSION

Mobile GIS has been a tremendous success for EPCOR with the field staff having access to all the utility's current spatial data. Based on the six years of production implementation, the decision to use desktop computers was the right one. Desktop use in the field may not be the solution for every company, but with EPCOR's small service territory it has worked extremely well for us. The implementation and ongoing costs are significantly less that the costs of equipping the field staff with prints.

Users in the field feel an increased ownership of the data because they have more control over it. They now can see direct benefits when reporting data errors to the office personnel. Additional tools enable the Power crews to use the system to prepare for switching orders and Water crews to use the system for water main isolation during main breaks.

The GeoEngineering Access application, which was written for the Mobile GIS solution, has become such a success that it is now used in the office by all the engineering staff. The First Call locator in Edmonton and the City of Edmonton staff also use it. In the future we hope to add wireless access to the EPCOR work management system and Automatic Vehicle Location to the EPCOR Mobile GIS solution.