CUSTOMER STORY

GIS, GPS Play Integral Role In Mapping Project Spanning 30 Years

PROJECT: Greater Toronto Airport Authority Archaeological Survey

PROJECT DATE: 2005

In the early 1970s, the Canadian government expropriated 18,600 acres of land in Pickering, east of Toronto, and began developing plans to construct a new airport to replace Toronto Pearson International Airport. Officials contracted with the Archaeological Survey of Canada, National Museum of Man (now Canadian Museum of Civilization) to organize archaeological studies to discover First Nations archaeological sites.

Ultimately, the archaeological survey enlisted the help of William D. Finlayson Ph.D., F.R.S.C., to direct all archaeological investigations. The airport project faced opposition from community activists and environmentalists, and was ultimately postponed.

Thirty years later, officials are still looking for a solution that will make air travel into and out of Toronto more efficient. The Canadian government still owns the land, and is once again revisiting the idea of developing the Pickering Airport. In April 2001, the Minister of Transport officially requested that the Greater Toronto Airports Authority (GTAA) undertake interim planning work for the development of a regional/reliever airport to Pearson, rather than a replacement.

As part of the planning for the development of the Pickering Airport, the GTAA re-enlisted the help of Finlayson, one of Canada's leading archaeologists and owner of This Land Archaeology Inc, an archaeological consulting firm, to undertake archaeological studies, including preparation of an archaeological master plan. This Land Archaeology arranged for Gartner Lee Limited, an environmental consulting firm, to develop a Geographic Information System (GIS) database to store all of the maps, aerial photos, findings of the original archaeological survey and other geographic data pertaining to the land, including the interpretation of 1946 and 2002 air photos.

Preliminary fieldwork was completedin 2005 and because archaeological standards are more rigorous now than they were 30 years ago, new methods had to be developed.

Finlayson and his team were tasked with completing a detailed archaeological inspection of more than 5,500 acres of land and, upon completion of the inspection, providing a detailed report with recommendations for handling archaeological resources found on the property.

Although the task was the same, the job was quite different for Finlayson and his staff, who worked at opposite ends of a 30-year spectrum. When archaeologists studied the land in the 1970s, they set out walking through corn and soybean fields carrying a paper map of the entire area, a notebook and a pencil. When an artifact was found, the archaeologists would count how many steps it was from the edge of the field, write down the details of the item and sketch a map of its approximate location.

Thanks to technological advances, Finlayson's 2005 team was able to complete a much more accurate survey of the land by using a Trimble® GeoXT™ rugged Global Positioning System (GPS) handheld receiver powered by Microsoft® Windows Mobile® version 5.0 software.

For 17 weeks in the spring of 2005, Finlayson and his team surveyed approximately 450 acres of land, carrying the GeoXT handheld as they walked up and down rows of corn and soybeans with no more than 15 feet between each person. The team of five uncovered more than 10,000 artifacts, providing valuable insight into the history of the land. Test excavations were also undertaken at a number of sites.

"We had to get permission to walk the fields because the land is currently leased to farmers, so we were very methodical about where we were going to be each day," said Finlayson. "Each night, we would upload an outline of the fields we were going to walk the next day from the GIS onto the GeoXT handheld. We would also print detailed aerial photos of that specific farm from the GIS."

Each morning, one member of the team would carry the GeoXT handheld, which was

PROJECT HIGHLIGHTS

- Modern technology simplifies mapping project that spans 30 years
- GPS technology used to locate, document more than 10,000 artifacts
- Seamless field-to-office solution helps archaeologists create detailed maps and reports
- Rugged GeoXT handheld ideal for field use

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recording GPS positions as they walked up and down the rows of crops looking for artifacts such as pieces of pottery and other evidence of past life on the land.

Once an artifact was discovered, the team would stop to collect the item and record information such as the type of artifacts(s) and the number of pieces. The GeoXT handheld automatically collected spatially accurate location information and each item was then given a unique identification number.

In areas that were less accessible, such as those covered by bush or weeds, the archaeologists dug test pits, which were approximately 30 centimeters in diameter and 25 centimeters deep, at five-meter intervals. Soil from the pits was screened through a quarter-inch wire mesh to catch any artifacts. In one test pit, for example, several pieces of early European Canadian pottery were revealed, which led the team to uncover evidence of a previously undiscovered mid-19th century weaver's house at that location. Once again, all of the data about the artifact and the location was recorded on the handheld GPS unit.

At the end of each day of field work, Finlayson's crew returned to the field lab, where they connected the GeoXT handheld to a laptop computer and uploaded the locational data on all artifacts and other features into the GIS database. Once in the GIS, Finlayson used ArcGIS software from ESRI to create numerous maps, charts and other visual representations of the work completed in the field.

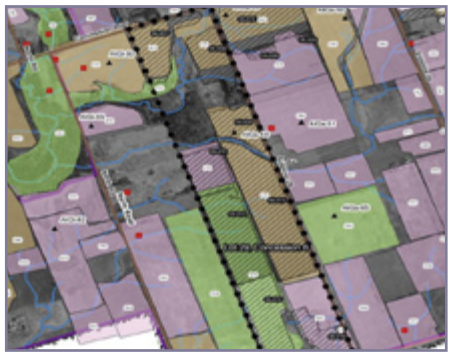
"Using ArcGIS, we could superimpose the data collected in the field on the aerial photos, add information about our findings to topographic or property maps, or create our own detailed maps about the area we covered and the artifacts we uncovered," said Finlayson. "Our report is extremely visual, with a whole series of maps to illustrate our work."

In one instance, for example, the 1878 property map clearly indicated the presence of a farmstead at a specific location. However, the survey of the field in which this structure was supposed to have been located did not uncover a clustering of artifacts to suggest the presence

of a mid- to late-19th century farmstead. The property map was determined to be incorrect, based on the finding of a few, isolated artifacts at the site.

"Because the older methods of collecting and recording information were less accurate, there were instances when the maps were simply wrong," said Finlayson. "Now, we have a tremendously visual, accurate report that will be much more readable, and probably more widely used. You just can't do the kind of reporting we did without the GPS and GIS technology."

By utilizing this new technology, This Land Archaeology was able to produce accurate reports summarizing archaeological information, which will be incredibly useful for future planning on the site.



THE EQUIPMENT USED ON THIS PROJECT INCLUDES

- GeoXT handheld
- ESRI ArcGIS software

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