

Ontario Imagery

By Mike Robertson, Policy Analyst, Land Information Ontario, Ministry of Natural Resources

Aerial photography has been used for decades to satisfy a wide variety of business needs and is now expanding rapidly across both public and private sector organizations. The first use of aerial photography was for surveys and mapping in the early 1900's. The Surveyor General of Canada at that time, Captain E.G.D. Deville, pioneered the use of photography to map topographic features. Beginning with the plotting of maps using photographs taken from mountain tops and then moving to aerial photography using British wartime flying boats, Captain Deville organized the first experimental survey over Ottawa in 1920. This revolutionized topographical surveying methods and put Canada in the forefront of aerial photography and mapping.

Over the years, camera technology improved and large frame aerial cameras became the standard method of mapping not only topographic information but also forestry, land use, infrastructure planning, municipal planning and many other features across the landscape. Various scales of photography were acquired and photogrammetry expertise became a much sought after commodity.

All aerial photography was acquired using film-based cameras until the late 1990's early 2000's. That meant that the photography needed to be developed and printed in hard copy to be of any use. It also required massive amounts of cabinet space, as well as storage facilities that were climate controlled to ensure that the film negatives were not compromised.

Most aerial photography acquisition programs were conducted primarily by provincial and federal governments to provide accurate mapping of topographic features over time. The Province of Ontario has been using aerial photography since the early 1940's and has tried to update that photography on a regular basis. Within the Ministry of Natural Resources (MNR) aerial photography has been used for forest resource inventory programs, monitoring wildlife habitat, forest fire management and a variety of other program needs.

The largest, single purpose aerial imagery acquisition program that Ontario was involved in was to create the Ontario Base Map (OBM). That project required 17 years of aerial photography campaigns, with southern Ontario being acquired at a 1:10,000 scale and northern Ontario being acquired at 1:20,000 scale. One of the reasons for the length of time it took was due to the fact that the OBM program required leaf off imagery in order to "see" below the tree canopies. This made for a very limited window of opportunity to capture those photographs, especially in northern areas. Ground control standards were also put in place and used to georeference the photography. Those photos were

then used to generate vector mapping for roads, water, rail, buildings, woodlands, wetlands and other topographic features, including a digital elevation model. The initial production of the OBM was hard copy paper maps. They became the standard for topographic mapping in the province and were widely used. In the late 1980's, early 1990's GIS was in it's infancy but the MNR decided to turn those paper products into much more useful digital files and embarked on a massive automation project, which changed the landscape for all mapping in the future.

The emergence of digital aerial sensors in the early 2000's greatly improved the processing of imagery. Scanning of film was no longer necessary and imagery was brought directly into a digital environment to be orthorectified and georeferenced to the ground. As with the film-based products, the accuracy of the data was entirely dependent on the quality and accuracy of the ground control points that were used to georeference the imagery. Another advantage of the standard digital sensors is the ability to acquire pan chromatic (black and white) as well as multi-spectral bands (red, green, blue, and near infrared). Those data provide users with additional information that can be used to analyze moisture content, vegetation health and other environmental considerations. Other types of sensors that are used include thermal and hyperspectral, which provide even more data for analysis and modelling, depending on business needs.

Aerial acquisition programs are not cheap, especially when covering a broad geographic area. Funding at the provincial and federal levels has been dramatically reduced for those programs, which has resulted in the data becoming stale and out of date. While some programs have been designed to update critical data such as roads and water, other data such as building footprints will never be maintained using vector data across the province. Due to limited budgets across the public sector, creative solutions were necessary to acquire high resolution imagery on a large scale.

In 2002, municipalities and Conservation Authorities in the Greater Toronto Area (GTA), as well as Land Information Ontario (LIO) collaborated on an ambitious aerial imagery acquisition that covered approximately 32,000 sq km. The concept of public sector partners across two levels of government actually "sharing" the costs of a project of this size was certainly not commonplace at the time. All organizations realized significant cost savings and that was the beginning of a series of very successful partnerships to acquire imagery across the province, primarily in southern Ontario.

Land Information Ontario has continued to build and foster large partnerships across the province and 2010 promises to be an exciting year for imagery acquisitions. Both public and private sector organizations have funded

projects over the past few years and the demand for more imagery is increasing dramatically. The use of imagery products is growing substantially and more organizations are coming to realize the value of quality imagery products.

A number of projects are either underway or nearing completion and we are looking forward to “filling in the blanks” where imagery may be needed. LIO will continue working with organizations across the province to assist them in acquiring high resolution imagery.

“A provincial imagery strategy is one of the key projects we want to complete this year. A strategy will provide a road map for imagery acquisitions in the future and will help us define where and when we will acquire imagery for Ontario”, says Brian Maloney, Director of MNR’s Geographic Information Branch and Surveyor General of Ontario.

It is critical for organizations to know when an area is being planned for acquisitions and the strategy will help LIO establish a regular schedule so that organizations can plan around those large imagery projects. More information will be released in the coming months, so stay tuned.

Past imagery acquisition projects have had a variety of technical specifications related to the positional accuracy of

the final imagery products. In general, most of the data Land Information Ontario has acquired through these partnership models has been georeferenced to the provincial base data, which was based on the OBM mapping. In 2009, the Ministry of Natural Resources and Conservation Ontario collaborated on the development of tighter specifications for georeferencing in order to support Source Water Protection initiatives that required much more accurate data. Those new specifications will provide users of that imagery with vertical and horizontal positional accuracies of 50 cm. This will not only improve the quality of the imagery but will also have a significant impact on vector data that will need to be adjusted based on more accurate information in the imagery.

Below is a snapshot of the more recent imagery acquisition projects that LIO has been involved in.

The Digital Raster Acquisition Project –East (DRAPE) project has completed the acquisition for all areas. The remaining imagery products will be delivered to partners by the end of June 2010.

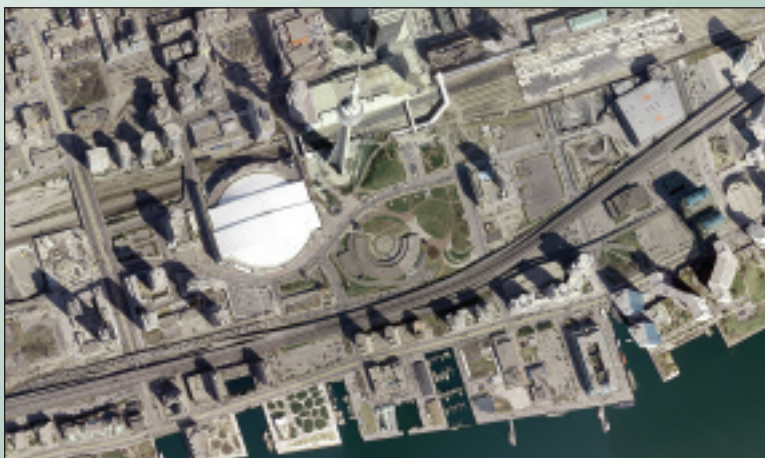
The South Western Ontario Orthophotography Project 2010 (SWOOP2010) is underway and leaf off imagery has been acquired. The SWOOP2010 project will acquire 20 cm resolution imagery across over 45,000 sq km in southern



Orthophotography of Gravenhurst, Ontario provided by the Ministry of Natural Resources. © First Base Solutions.



Orthophotography of Huntsville, Ontario provided by the Ministry of Natural Resources. © First Base Solutions.



Orthophotography of Toronto, Ontario provided by the Ministry of Natural Resources. © First Base Solutions.




Boulevard du Temple in Paris, France by Louis Jacques Mande Daguerre. One of the first aerial photographs - taken from a rooftop in 1838-1839.

Ontario, accurate to 50 cm. Updates will be provided to the over 70 funding partners through the SWOOP2010 web site (www.swoop2010.ca) and we have posted the progress of the flight acquisition campaign and will also post the data production process on that site as well.

The Forest Resource Inventory acquisition of 550,000 sq km will be completed this coming summer. There are approximately 110,000 sq km to be acquired and we are hoping for a good summer to complete the acquisition. Processing for those data takes approximately one year from acquisition to final delivery. Once this project is completed, Ontario will have comprehensive 20 cm imagery coverage for much of the land south of James Bay.

A consortium of partners in central Ontario has initiated a project to acquire 20 cm and 10 cm leaf off imagery in the North Bay/Sudbury/Manitoulin Island areas. That project is being coordinated by Blue Sky Net, with input from Land

Information Ontario. The goal is to acquire the imagery during the fall of 2010 and the spring of 2011.

The federal/provincial SPOT 4&5 imagery acquisition is nearing completion for the entire province. The raw data is being made available at no cost through the federal GeoGratis website. Land Information Ontario and the Ministry of Natural Resources are in the process of making that data more useable by pansharpening those data sets. As the data is processed it will be made available to users through Land Information Ontario. 

For more information on these and other imagery projects, please contact **Mike Robertson** at mike.robertson@ontario.ca or visit ontario.ca/lio.

Author's note: Many of the historical references to aerial photography in this article are courtesy of the National Air Photo Library, Natural Resources Canada.

Sites to See

GeoGratis

<http://geogratias.cgdi.gc.ca/geogratias/en/index.html>

GeoGratis is a portal provided by the Earth Sciences Sector (ESS) of Natural Resources Canada (NRCan) which provides geospatial data online at no cost and without restrictions via your Web browser. The geospatial data are grouped in collections and are compatible with the most popular geographic information systems (GIS), with image analysis systems and the graphics applications of editing software.