Testing the Capability of a Terrestrial-based Lidar Instrument to Inventory on-shore Assets from a Moving Boat

Slides by Eric Martin
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Presented by Michael Leslar P.Eng
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Project Outline

- **Objective**:
  - Illustrate the capability of acquiring on-shore assets while acquiring data from a moving vessel
- **Equipment**:

  ILRIS-HD^{MC} laser scanner
  CHS Vessel "Merlin"
  Existing POS-MV 320.
- **Set-up**:

  Installation took place at Optech's facility in Concord, ON - October 13/09.
  This included cabling, start-up, boresighting and commissioning.
- **Deployment**:

  Took place the following day.
  The planned route was along the north shore of Lake Ontario - Burlington to Bronte.

Project Outline

- **Data QA:**

  Data was collected and pre-processed back in the Electronics shop immediately following the mission
  A quick QA check indicated successful data collection, with no requirement to re-deploy the following day.
- **Post Processing:**

  Data was further post-processed at Optech to increase accuracy.
- **Analysis & Results:**

  Point cloud extracts presented
- **Sensor Fusion:**

  Integration of shore data with bathymetric data
- **Conclusion:**

  Sum up outcome of the collect

Objective

Optech has seen an increased interest in clients wanting to acquire lidar scan data in the coastal zone.

In many cases it is neither efficient or safe to obtain this data (or simply not possible) by being on the beach.

We have found that where a client already owns / operates a vessel equipped with a POS-MV system, ILRIS-HD-MC is a valuable compliment. It allows high-quality on-shore scans to be obtained while (in many cases) simultaneously acquiring bathymetric soundings at typical survey speeds (3-5 kt)

Equipment

Existing CHS Equipment included *Merlin* and a POS-MV 320.

Optech equipment included an ILRIS-HD^{MC} laser scanner, mounting bracket, hardware and cabling.

Equipment - ILRIS-HD - Tripod Mounted Scanner

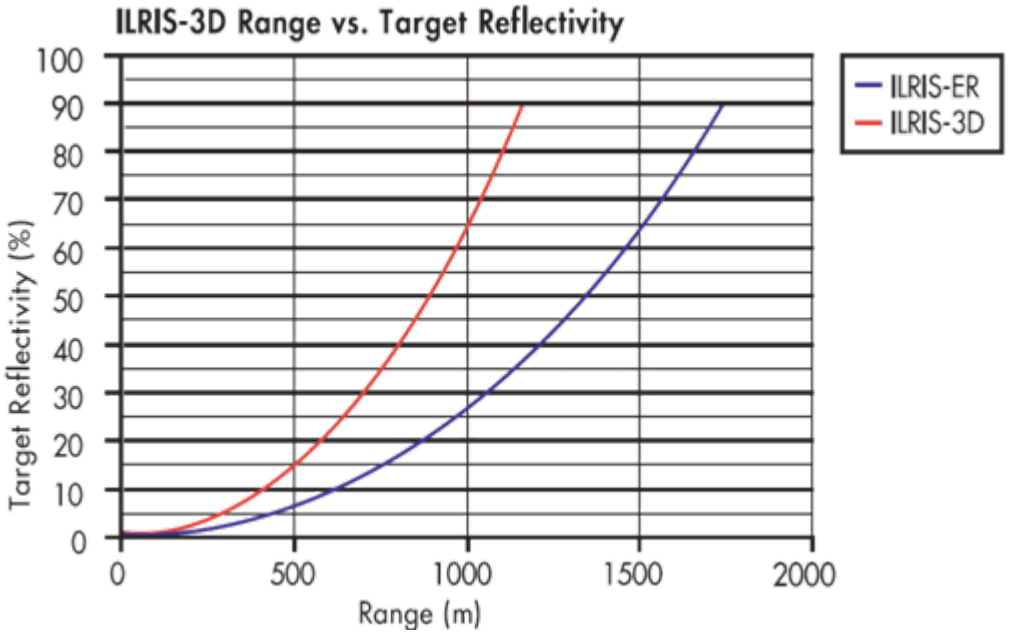
Optech's ILRIS-HD is a complete, fully portable, laser-based imaging and digitizing system for the commercial survey and industrial market.

ILRIS-HD

- 10,000 Laser Points per Second
- FOV 40º x 40º, extends to 360º x 110º
- Measurement Ranges > 1,000m
- Integrated Digital Camera w/ RGB overlay onto XYZ point clouds
- Class 1 Eyesafe
- Modular Design

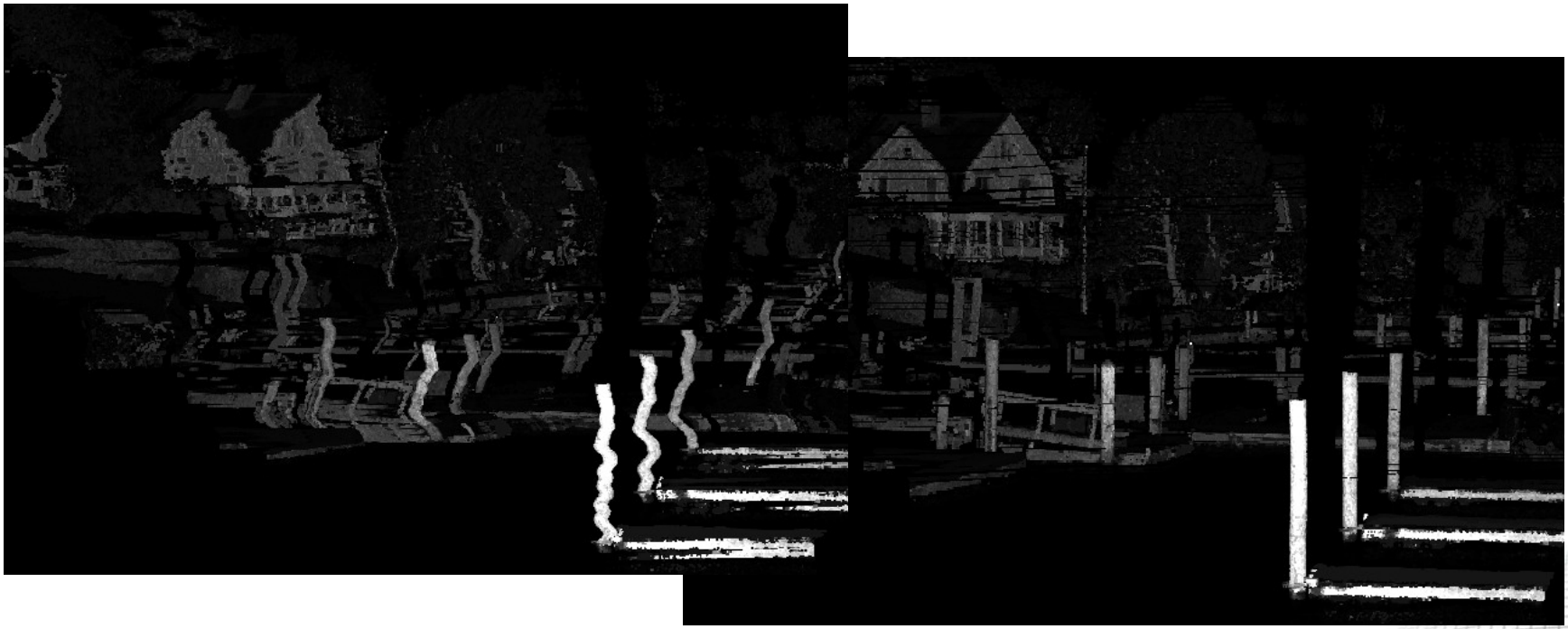
Equipment - ILRIS-HD^{MC} – Primary Features

- Economical method to re-deploy existing tripod-based scanner hardware and a client's existing POS system
- Provides high-resolution point cloud data (equivalent to being stationary)
- Ranges in excess of 1 km



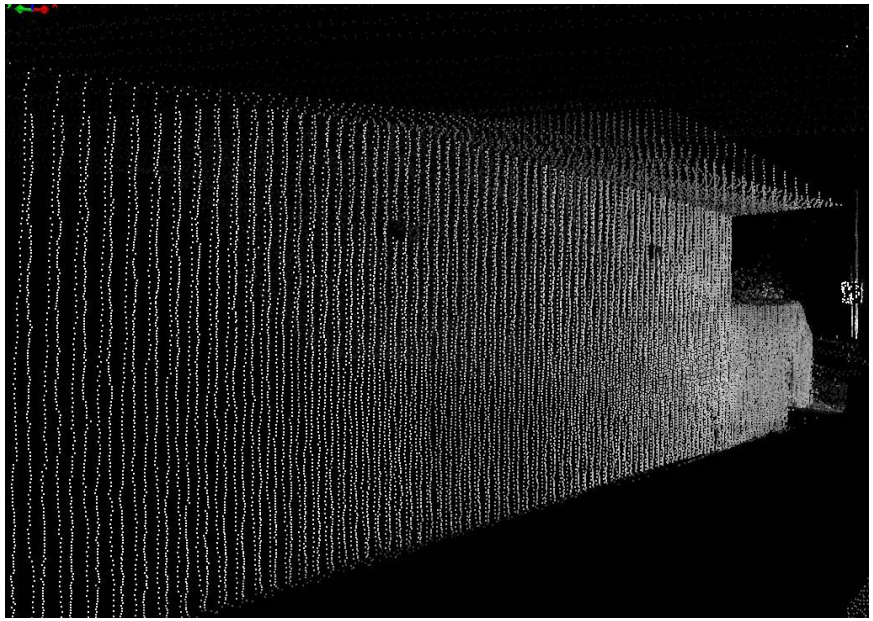
Equipment -ILRIS-HD^{MC} Scan Patterns

- 2 Scan patterns available:
- Step-stare raster scan - same scan pattern used for tripod scanning. Suitable when *nominally* stationary.



Equipment -ILRIS-HD^{MC} Scan Patterns

- Profile scan
  - Optional scan pattern is also on ILRIS-3$_6$D systems
  - Single axis scan (vertical) – rover forward motion provides 2nd scan axis



Set-up - Mounting

- The ILRIS scanner was rigidly mounted off the port-side on a ¾” plywood panel bolted to the rigging platform near the stern.

Set-up - Cabling

- Standard cabling was run from the scanner back to the cabin. These included:
  - Power cable (120VAC converted to 28 VDC using Optech's standard power supply)
  - 75 Ω Video cable for pps sync (to POS-MV)
  - Serial cable (to POS-MV)
  - Ethernet crossover cable (to field PC)

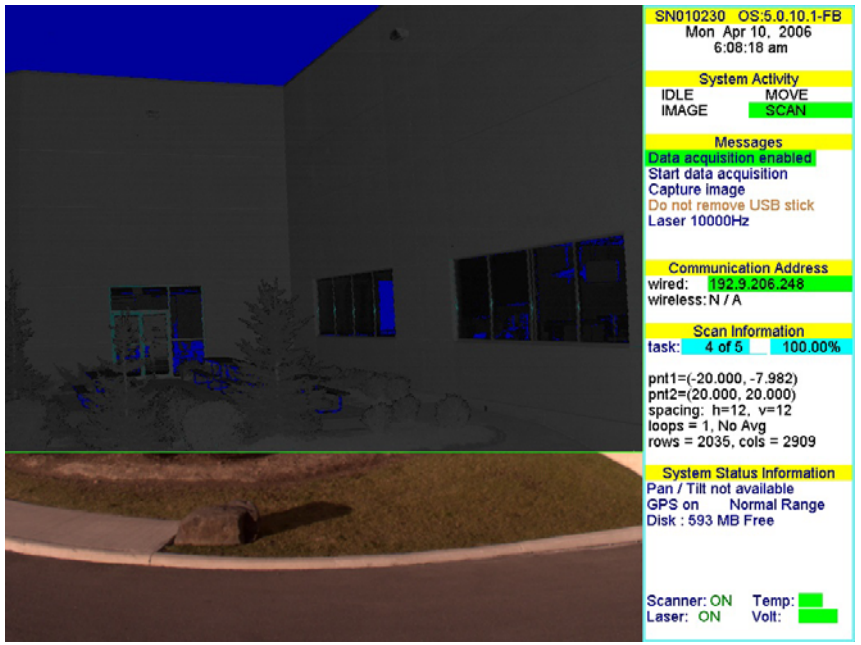
  Data was collected both at the scanner locally (via USB) and remotely by the field PC.

Set-up – Commissioning

- Once the scanner was installed, it was surveyed in with a total station with respect to the RP on the vessel and the GPS antenna in order to calculate the lever-arms.
- Aside from temporarily unscrewing the GPS antennas for surveying, no existing components were disturbed.

Set-up – Commissioning

- After ringing out the cabling, a boresight scan was taken.
- This was done by backing the trailer up a few feet and scanning a known artifact (a part of Optech's building with known ECEF coordinates) while simultaneously acquiring POS data.

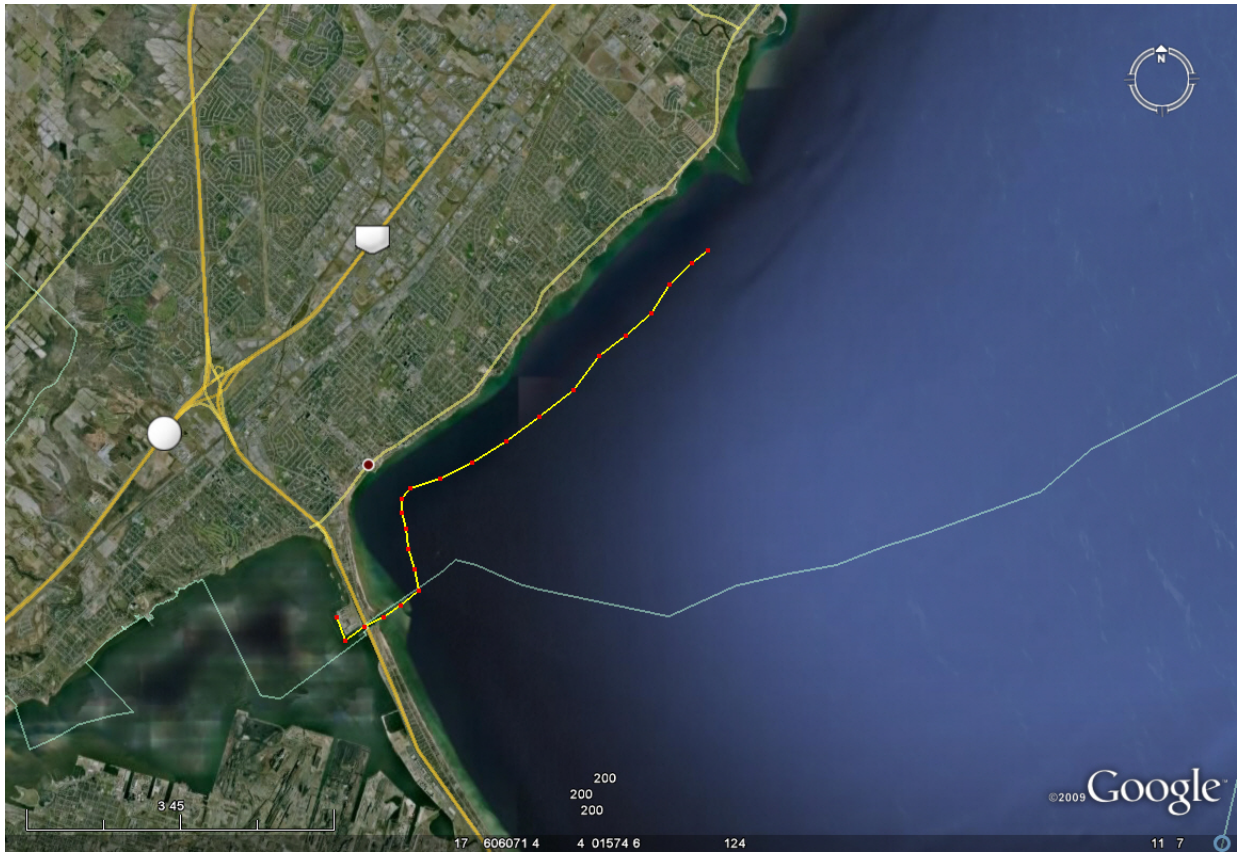


Deployment

- Deployment went off as scheduled the following day (October 14th).
- The ILRIS scanner was replaced on its mounting platform (removed for transit the night before).
- The GPS base station was setup over the station plug at the CHS Helicopter Pad logging data for the duration of the field mission.
- Crew compliment was 2 CHS personnel and 2 Optech personnel.

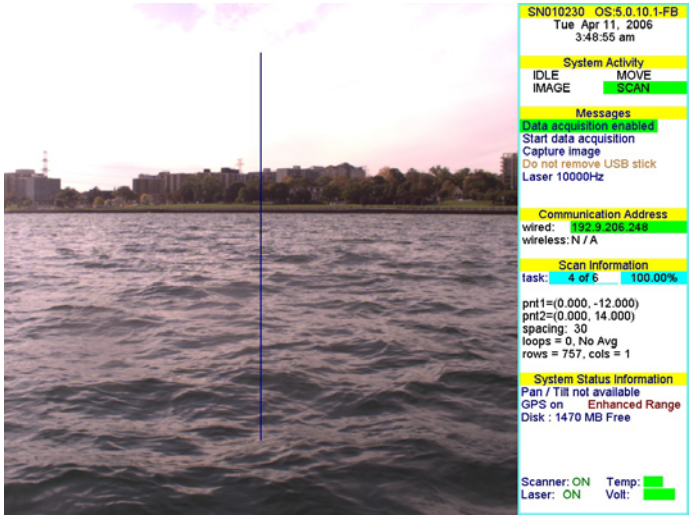
Deployment – Route Planning

The mission route was out of Hamilton Harbor and along the north shore of Lake Ontario along the Burlington shore, just west of the old Shell Pier in Bronte (~6 nm one-way).



Deployment – Data Acquisition

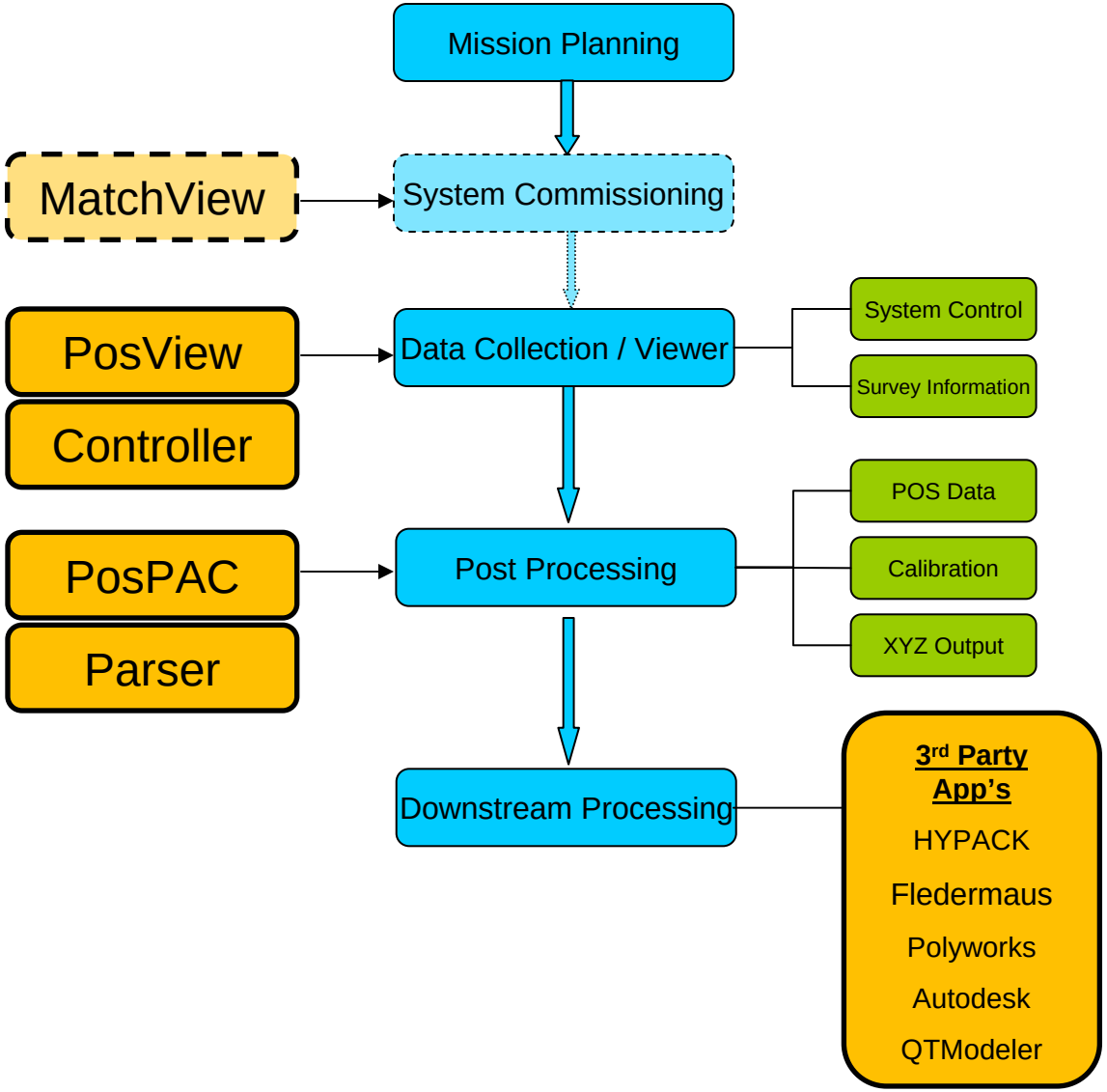
- Lost GPS immediately after passing under Lift Bridge (low lift) - needed to reset POS.
- Held a 5kt forward vessel speed during survey keeping a few hundred meters from shore.
- Scan pattern was vertical linescan. Data stored both locally at scanner as well as remotely (project PC)



Data Retrieval

- Lidar data is then post-processed in order to obtain best accuracy.
- Upon returning to the dock, data was retrieved from multiple sources and logically arranged in a project folder:
  - Base station data downloaded to project PC
  - POS-MV data copied to project PC
  - Local ILRIS scanner data copied to project PC

Post Processing - General Workflow



Data QA

- Before leaving site, data is checked for integrity.
  - Following the steps in the above slide, base station data (converted to RINEX in this case) is combined with POS data to calculate an SBET.
  - The scan data is combined with the SBET in the ILRIS parser, to obtain a corrected geo-referenced dataset.
  - This can then be quickly viewed and analyzed (completed onsite).

Data Post Processing

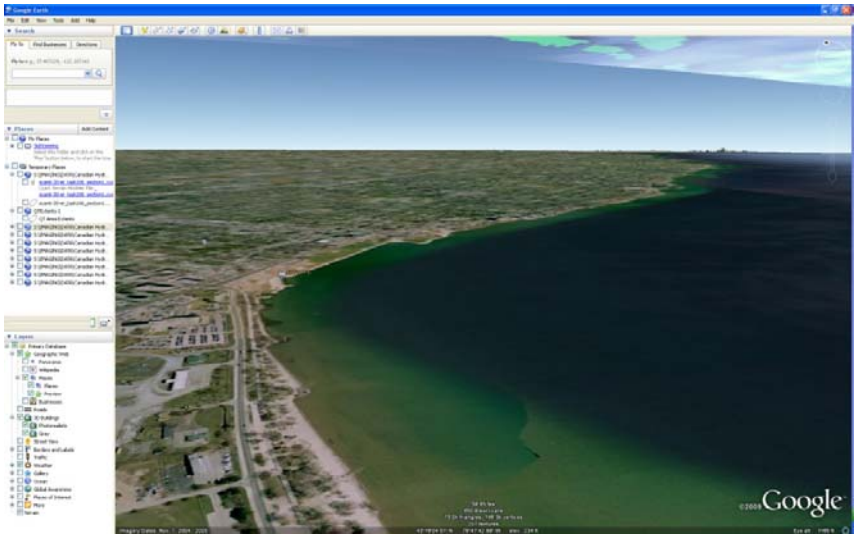
- Although the QA check provides “good looking” data, for best accuracy, the base station data is further corrected in post processing.
- This is corrected using either monument data or online using CSRS (Canadian Spatial Reference Service) or OPUS (Online Positioning User Service).

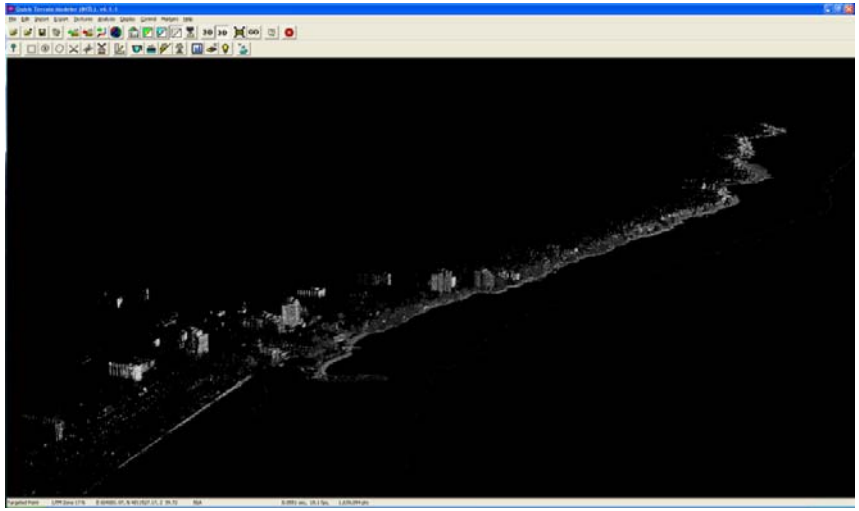
Analysis & Results

- The following slides are a sample compilation of screenshots.
- Wherever possible, these are shown accompanied with visuals from Google Earth
- In this exercise no independent ground control was available, however in past missions point cloud data from ILRIS-HD^{MC} is typically held to +/- 5cm absolute accuracy or better, depending on GPS and boresight.

Data Samples

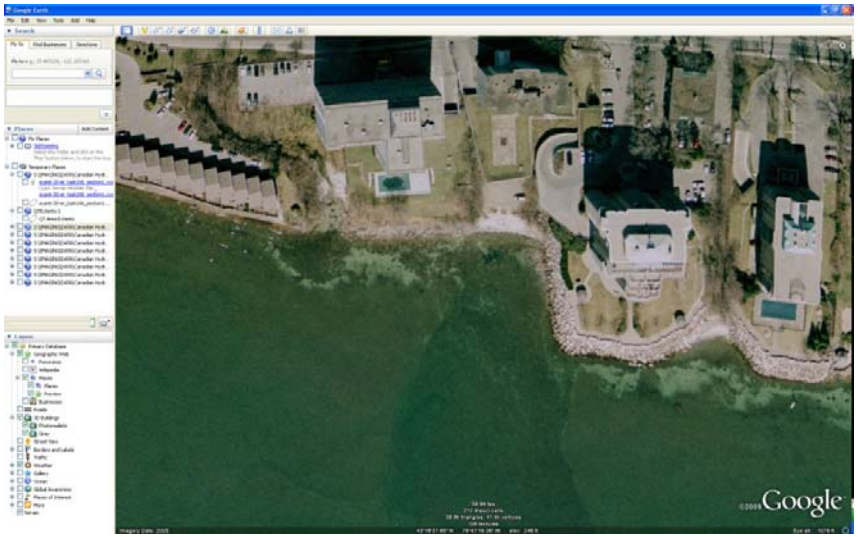
- Full data extents – Burlington to Bronte.

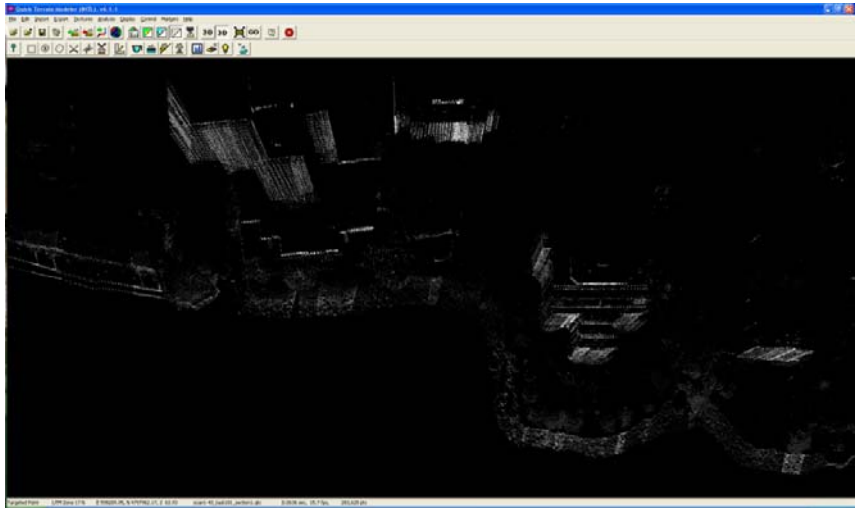




Data Samples

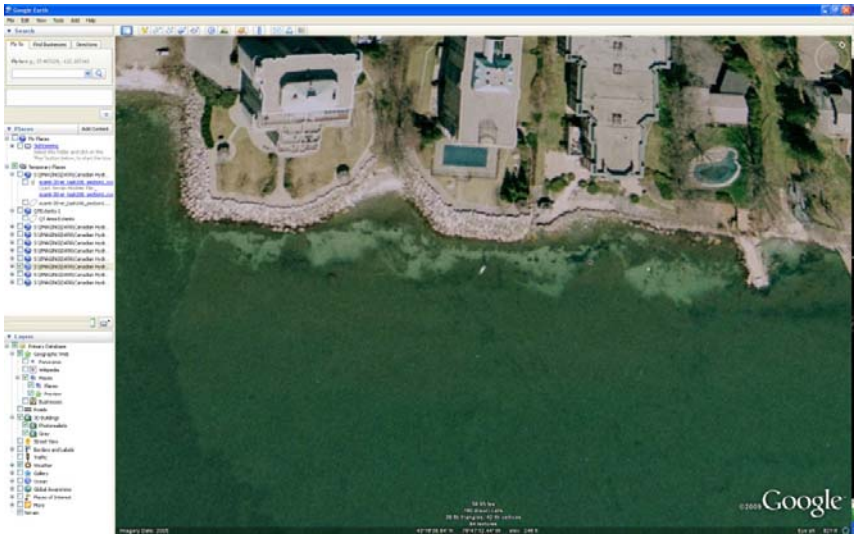
- Downtown Burlington showing beach area.

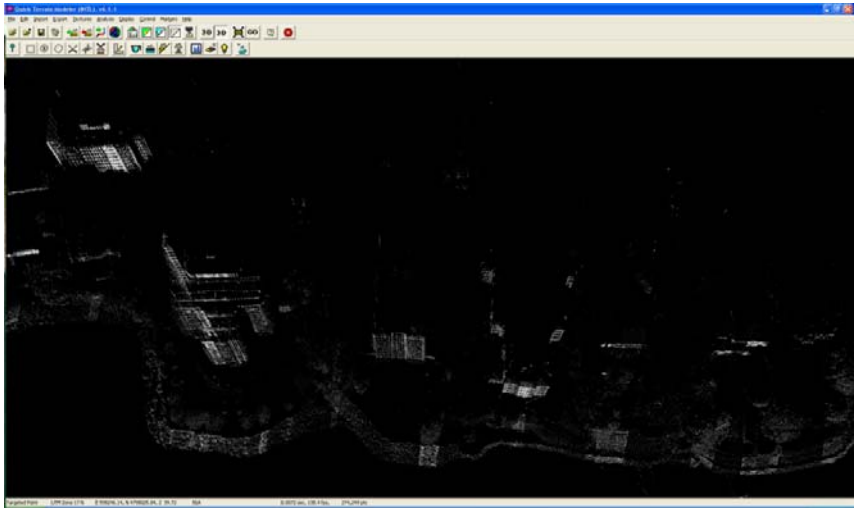




Data Samples

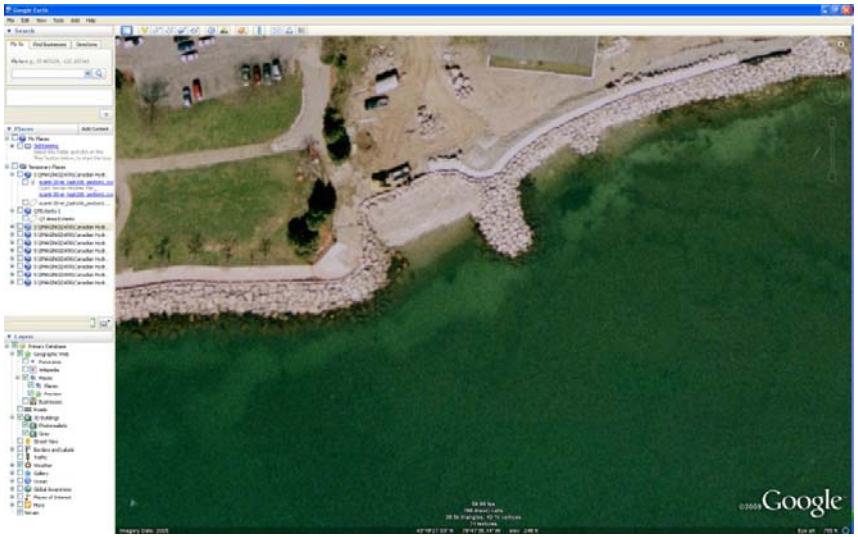
- Downtown Burlington showing beach area (cont'd).

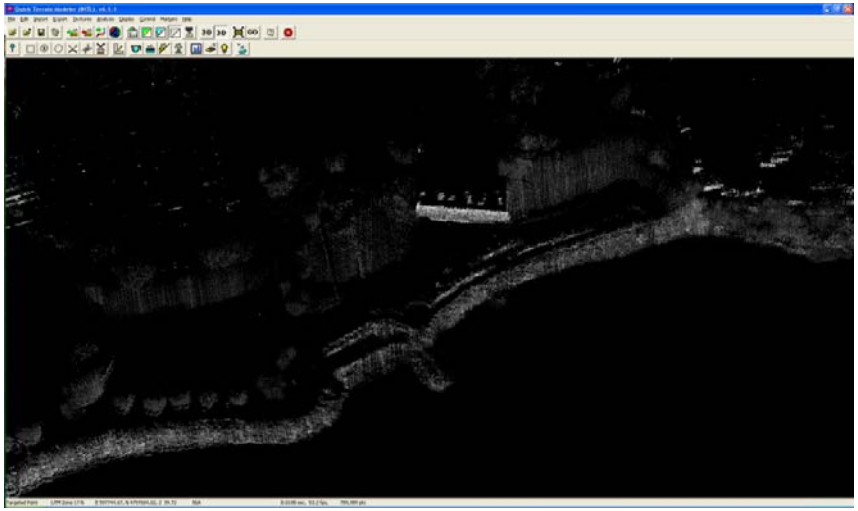




Data Samples

- Rockwall detail.



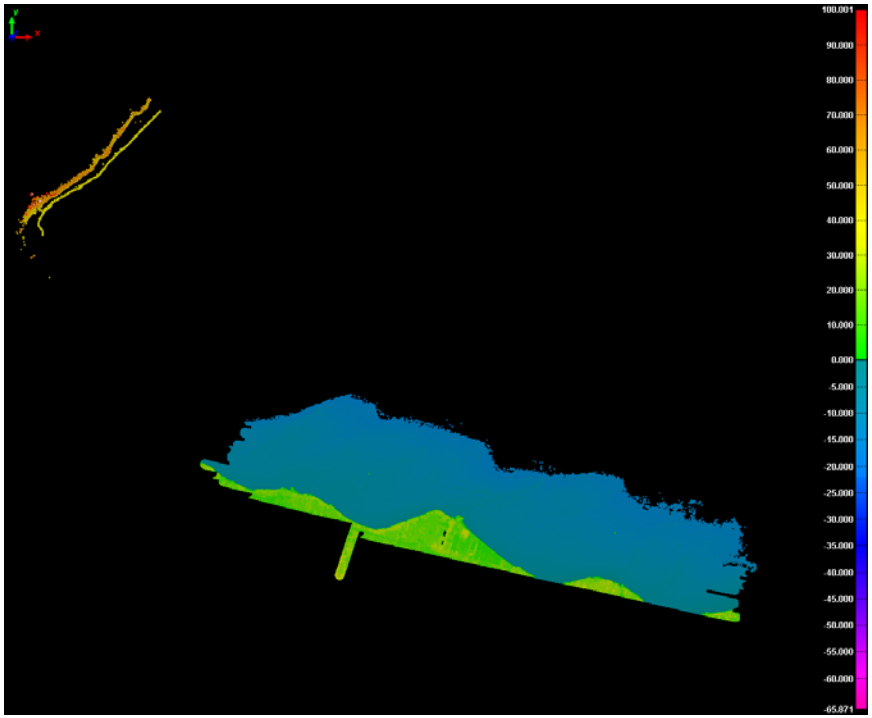


Sensor Fusion

- Data was collected along the south shore of Lake Ontario using the Optech SHOALS.
- Integration of the ILRIS MC data and the SHOALS data was accomplished through conversion of the SHOALS data into the UTM 6 degree zone coordinate system.
- The two data sets were collected for different areas of the lake and therefore don’t overlap.

Sensor Fusion

- ILRIS and SHOALS data.



Conclusion

- The ILRIS was able to successfully collect on shore assets in high detail from a moving vessel.
- Commissioning of the system was accomplished in approximately one day.
- Deployment ensued the following day and took about 3 hours.
- Estimates of the error for the POS MV 320 trajectory remained under 5cm for the entire collect.

Conclusion

- Multiple onshore assets were collected with enough detail for dimension extraction and modelling.
- Integration of the ILRIS data with SHOALS data collected in the same area was automatic.

Optech