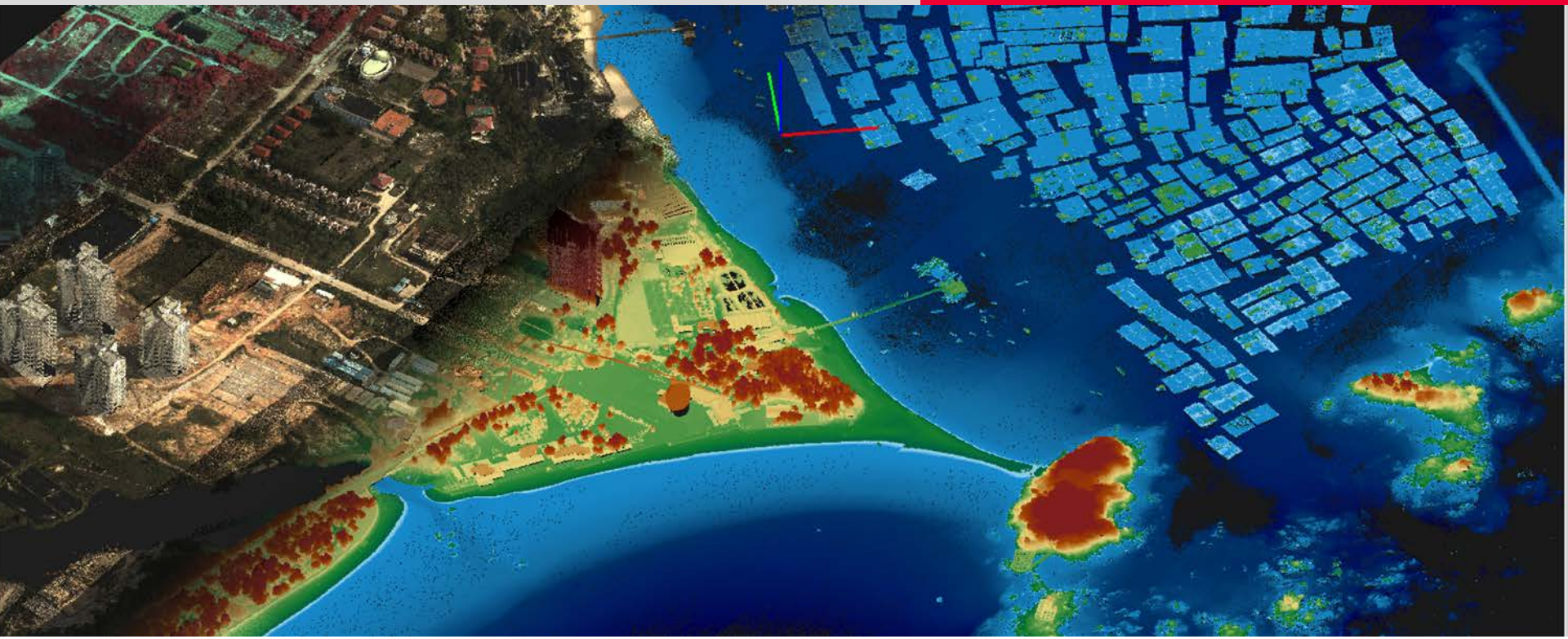


# Leica topo / bathy LIDAR
## New developments within bahty LIDAR

Anders Ekelund, VP, Airborne Scanning

Leica Geosystems, Geospatial solutions division

Version Date: 2015-06-17

- when it has to be right

# AHAB - History

1995 | 2005 | 2008 | 2012

## HawkEye I

Bathy: **200** Hz

Topo: N/A

Camera: N/A

## HawkEye II

Bathy: 4 kHz

Topo: 64 kHz

Camera: 2MPix

## DragonEye I

Topo: 200 kHz

Camera: 16MPix

## Chiroptera I

Shallow Bathy: 35 kHz

Topo: 400 kHz

Camera: 60MPix Frame

5Mpix QA

# Leica Geosystems - Topo / Bathy LIDAR Portfolio

## A series of sensors for simultanious survey of land and sea-floor

### Dual DragonEye

Topo : 1000 kHz

Dual Oblique Scanning

Camera: RCD30 RGBN (80 MPx)

### Chiroptera II

Shallow Bathy 35 kHz

Topo 500 kHz

Camera: RCD30 RGBN (80 MPx)

### HawkEye III

Deep Bathy 10 kHz

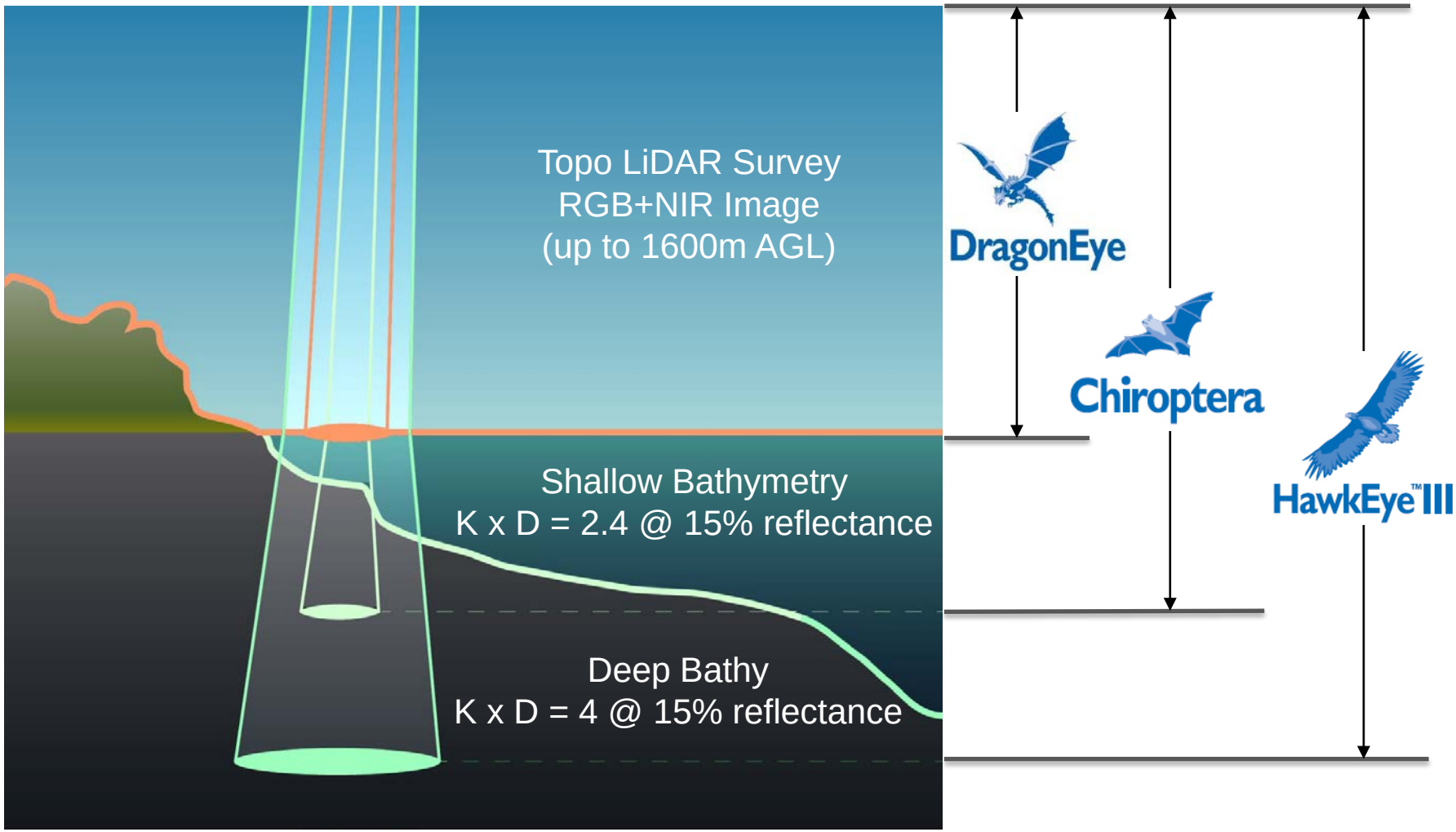
Shallow Bathy 35 kHz

Topo 500 kHz

Camera: RCD30 RGBN (80 MPx)

# Leica Geosystems - Topo / Bathy LIDAR Portfolio

## A series of sensors for simultanious survey of land and sea-floor



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# Common sensor platform

## Common system peripherals to all Leica airborne sensors

Common system peripherals

Unique in industry

Cost savings

Shared components

Flexible aircraft installation

Synergy across all sensors

Efficient workflow

Reduced Training

- when it has to be **right**

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# Medium format camera

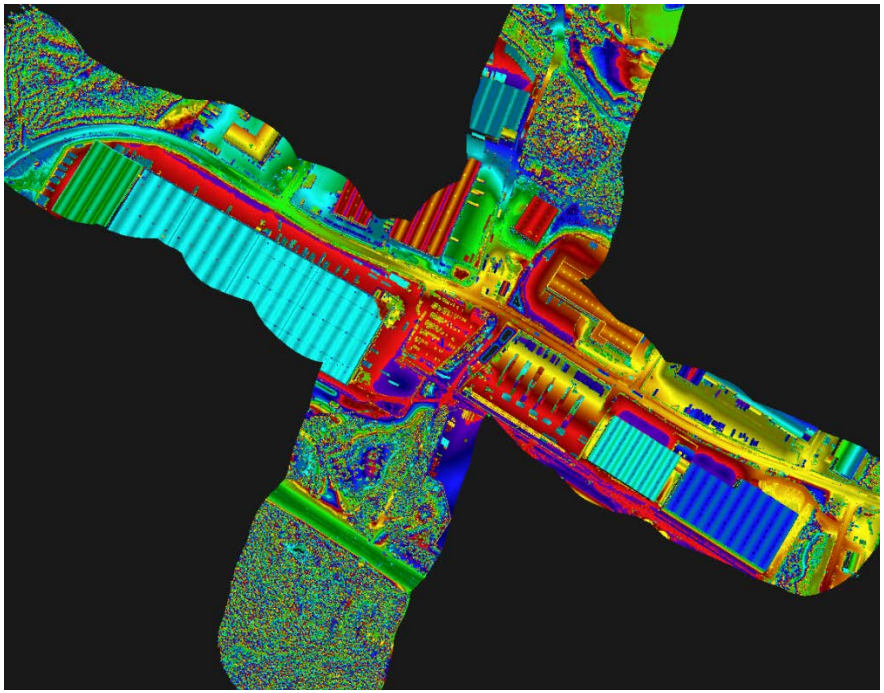
## Leica RCD 30 Integrated

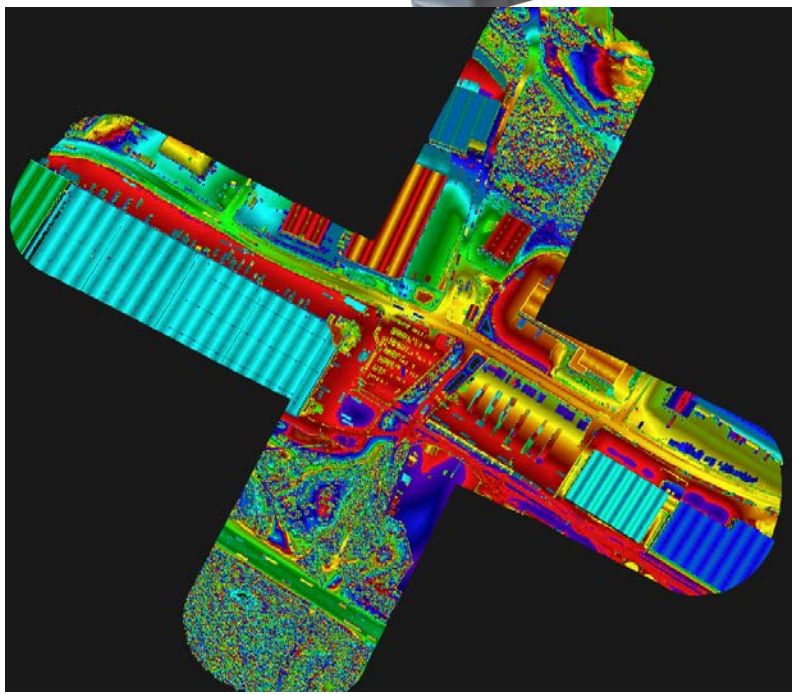
- **80Mpixel frame CCD** (10336 x 7788 pixels)
- **Photogrammetric accuracy**
- **4-band imagery through a single lens**
- **Forward motion compensation**
- **1 second cycle rate**
- **Compact and lightweight**

# PAV 100 installation

## Chiroptera / Dual DragonEye install

**Up to 35% productivity increase**





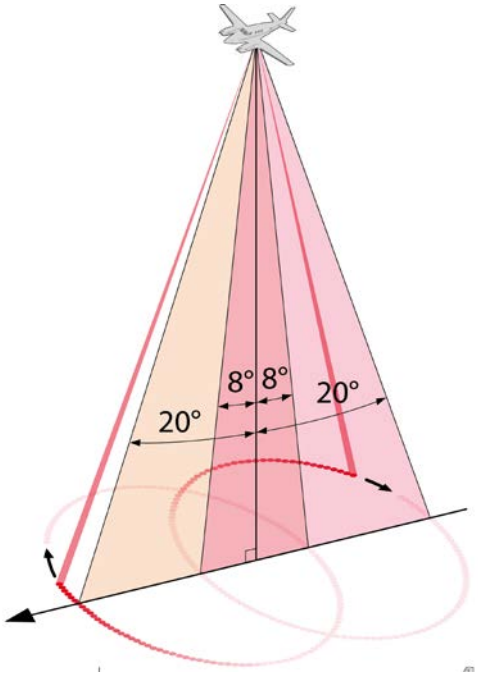
# Chiroptera II aircraft installation

# HawkEye III dual hatch aircraft installation

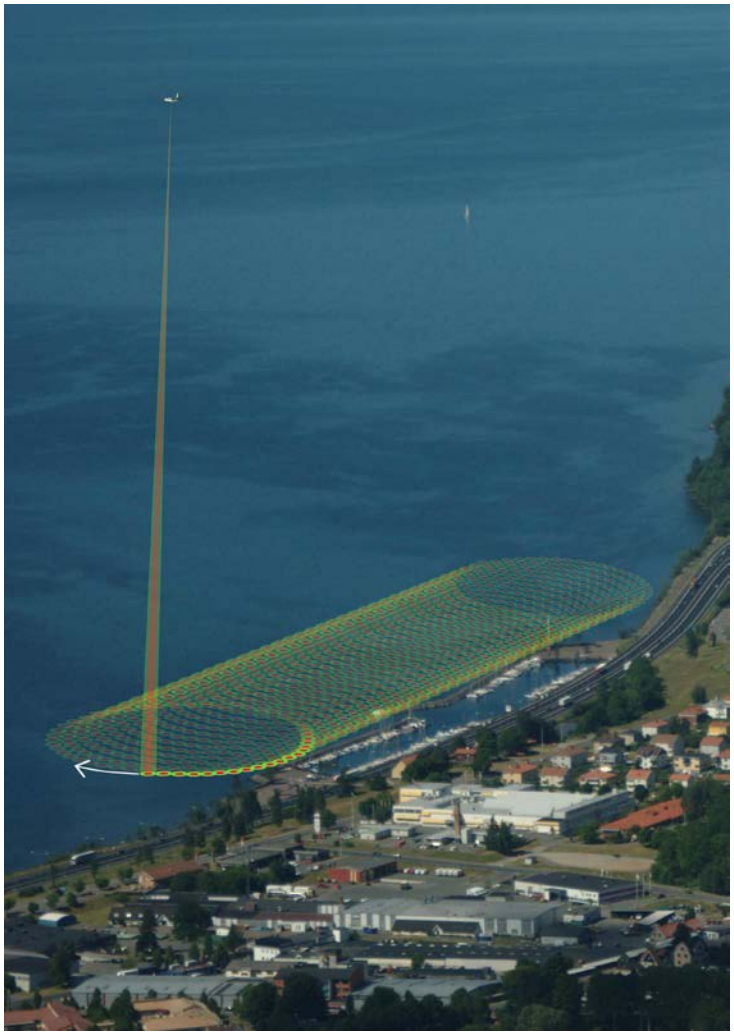
# Oblique LIDAR

## Lidar coverage from multipe angles

- Seafloor coverage
- Object detection
- Reduced white water effects



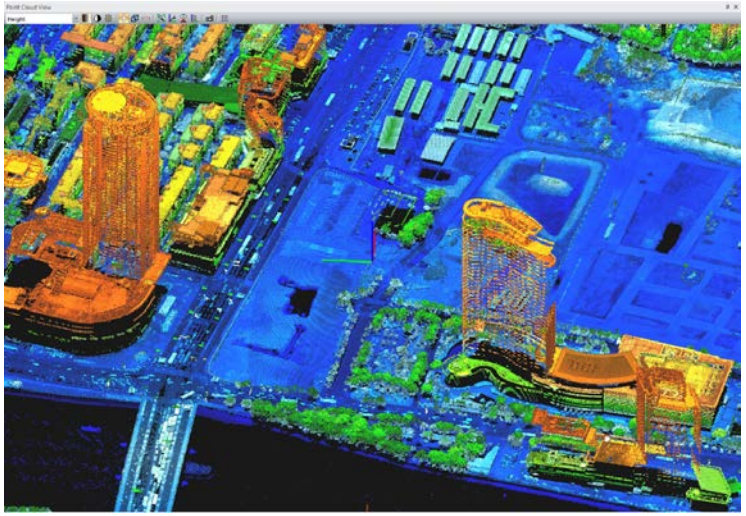

Dual DragonEye

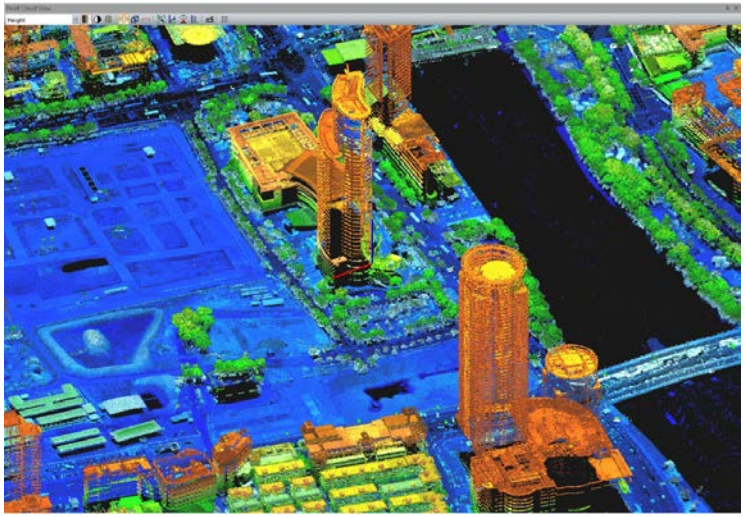


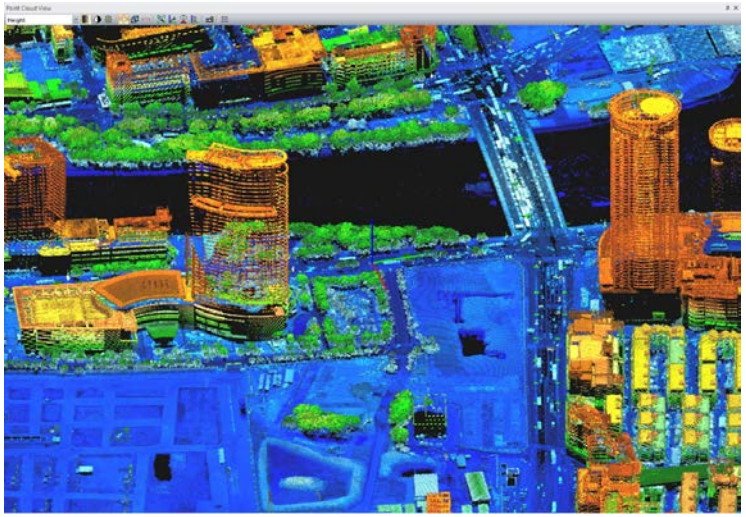
Chiroptera II and HawkEye III

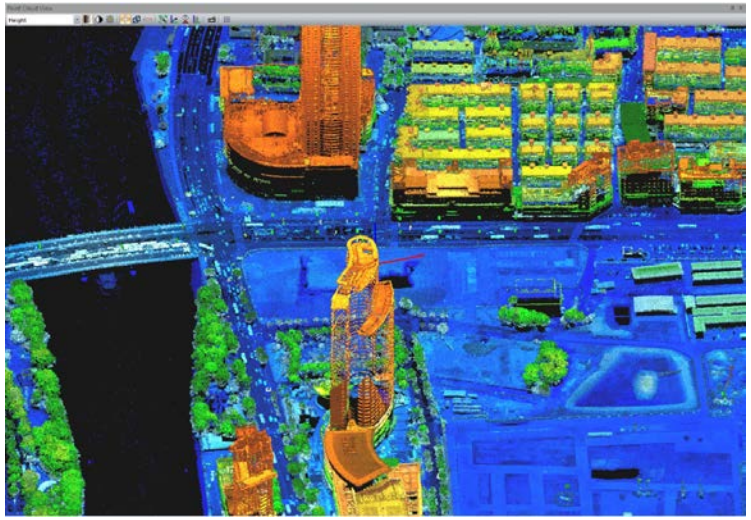
# Oblique LIDAR

## Generates point cloud data from all sides of vertical structures









# LIDAR Survey Studio

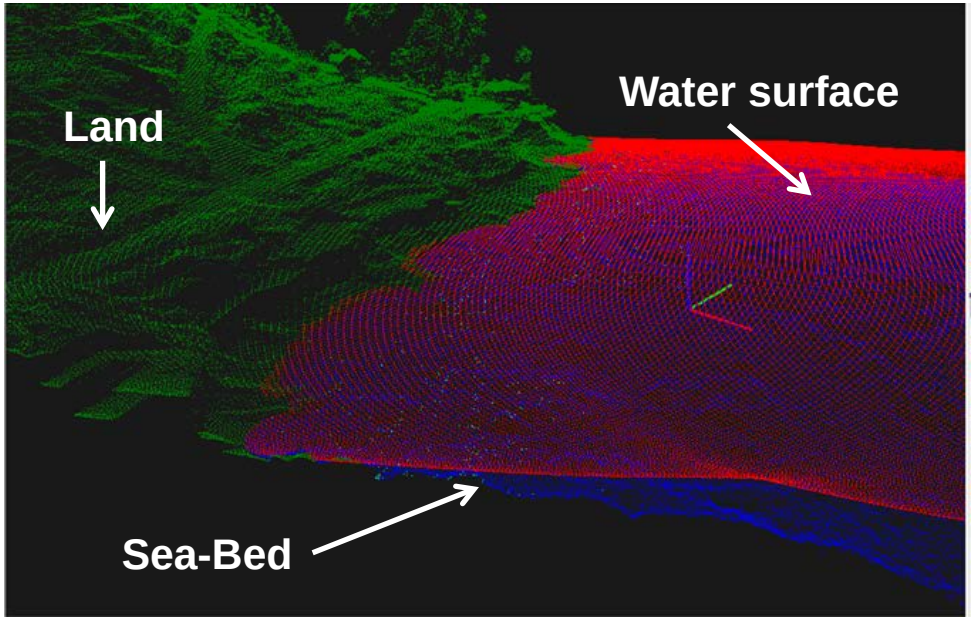
## An efficient workflow for topo/bathy LIDAR data processing

### LIDAR processing

- Conversion of all LIDAR waveforms to LIDAR returns
- Flight trajectory import and transformation

### Automatic bathy corrections

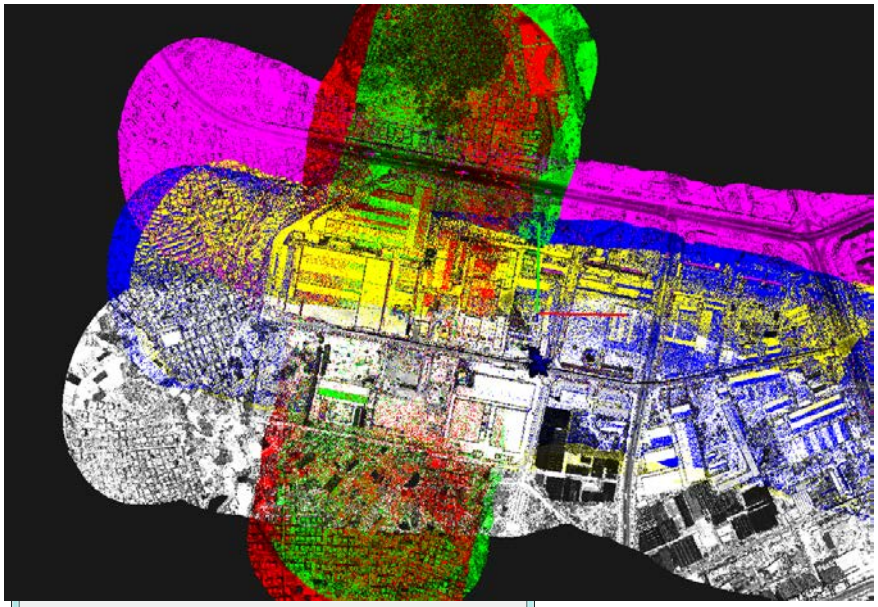
- Automatic water refraction correction
- Automatic LIDAR data classification
- Turbid Water Enhancement
- Shallow Water Technology

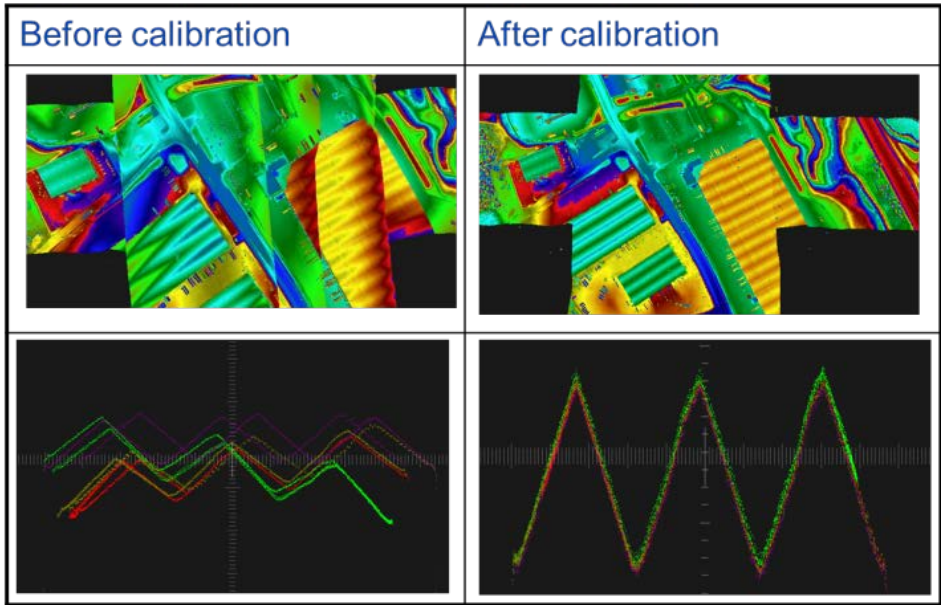


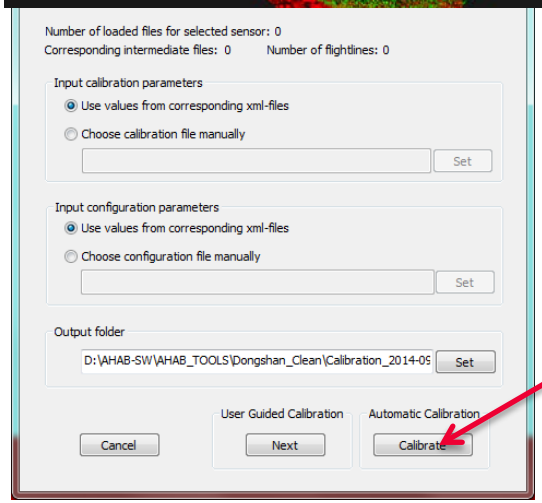

**Automatic data classification**

# LIDAR Survey Studio

## Automatic calibration



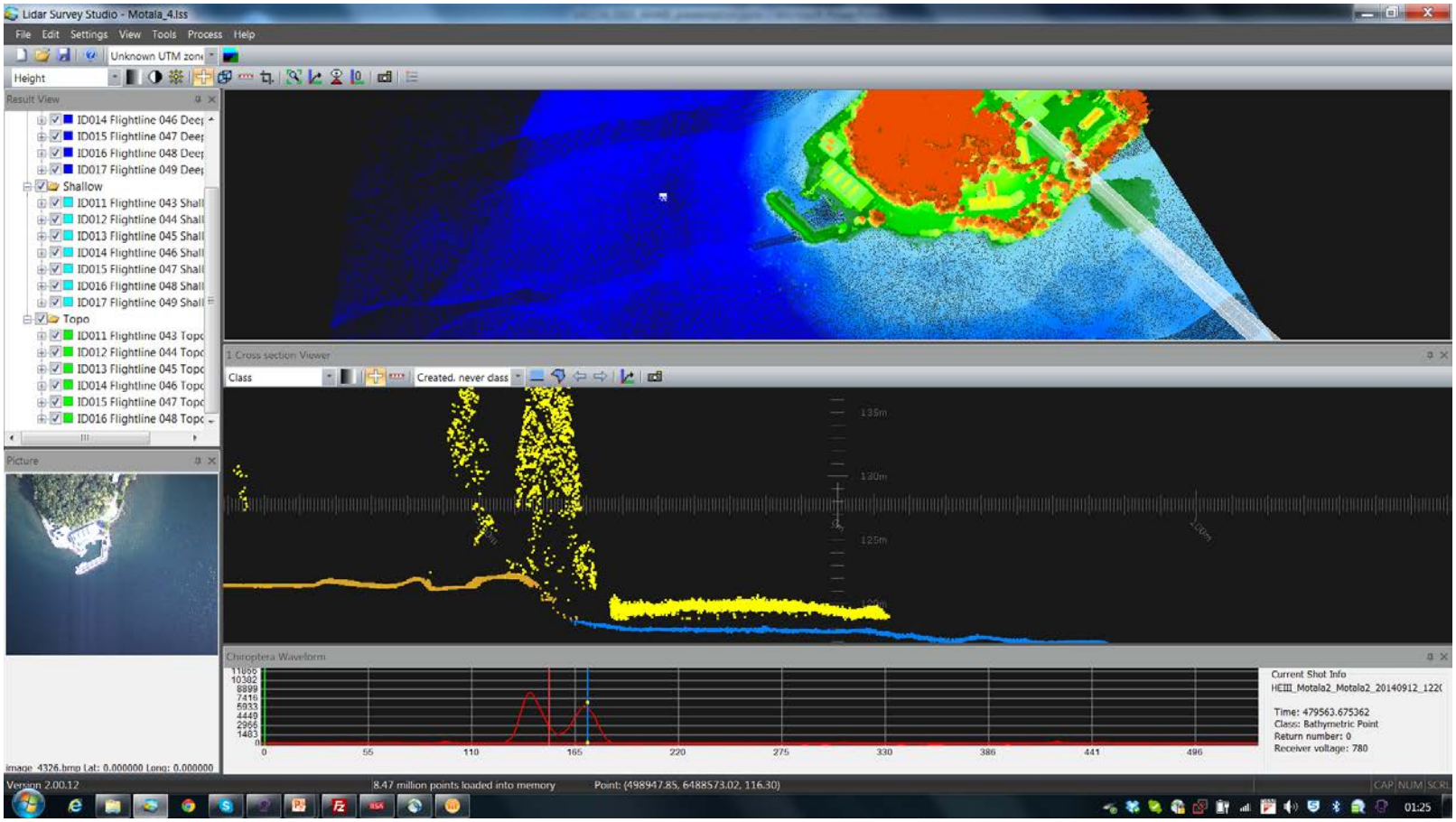



**Calibrate**

# LIDAR Survey Studio

## Visualisation / Editing

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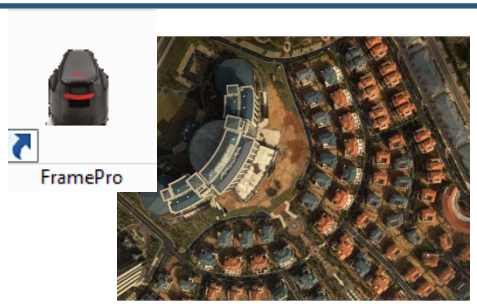
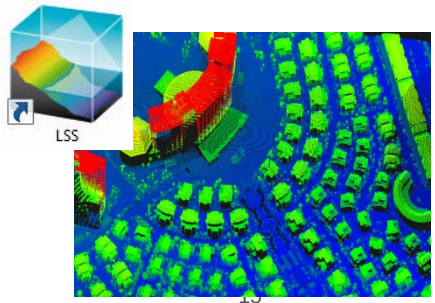
# LSS – Colorize Point Cloud

## A ”turn-key” solution to generate RGBN colorized point clouds

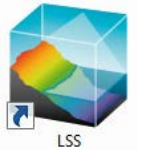



RCD30 RGBN image

Image EO




LiDAR point cloud

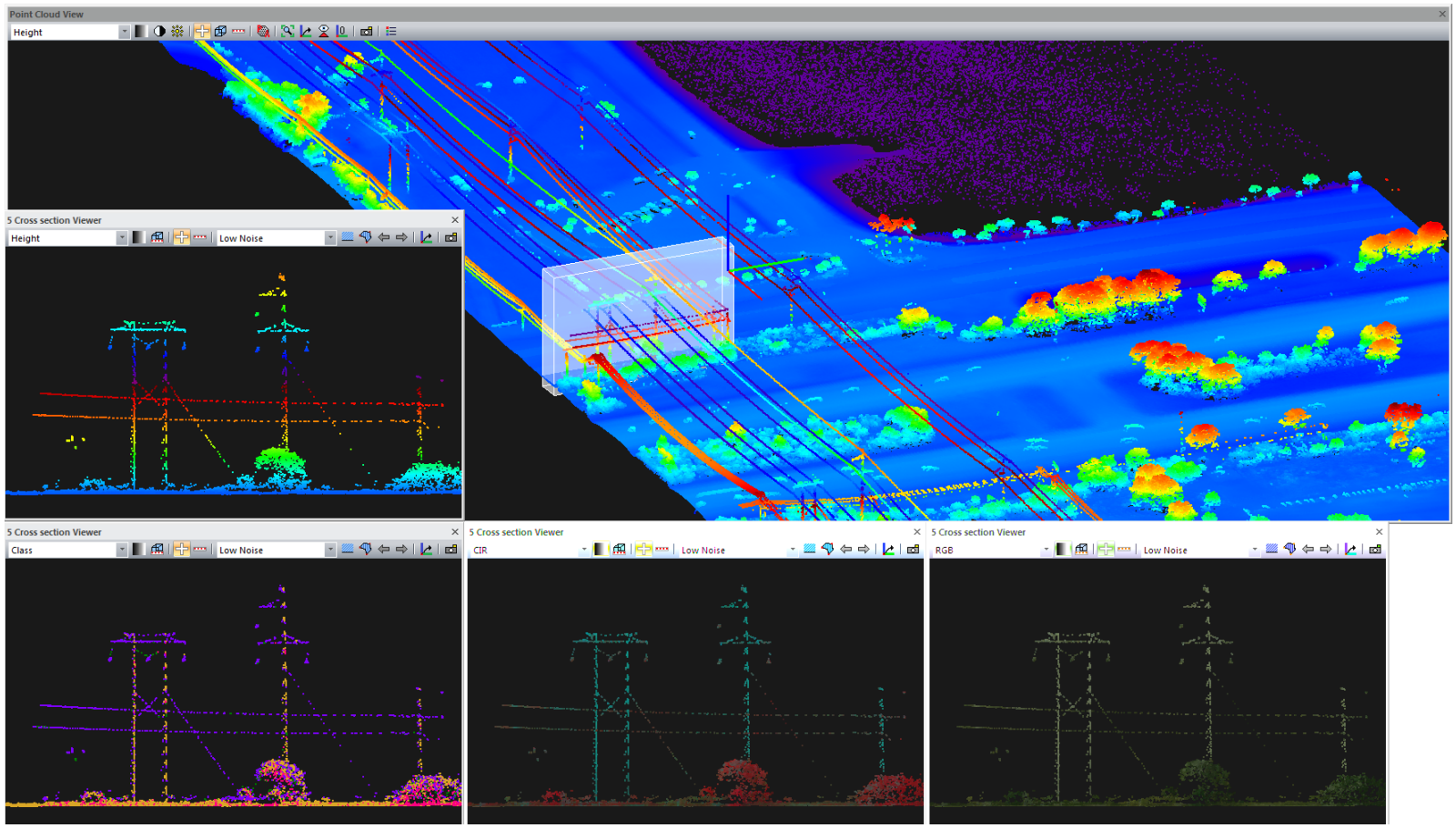



LAS Coloring Tool

RGBN colorized point cloud

# Power Line Mapping

## Sarasota US, example Chiroptera @ 500 m altitude



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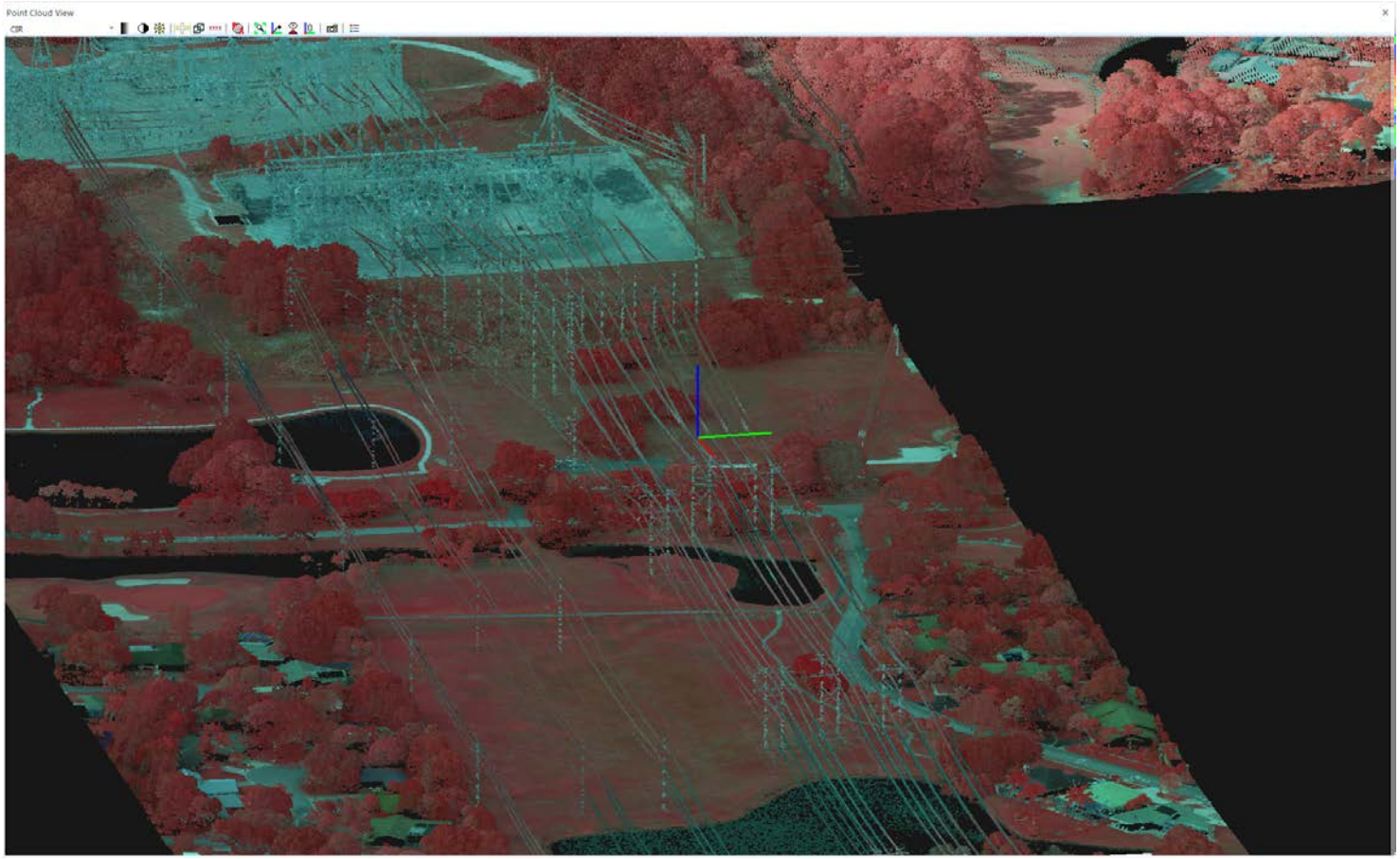
# Power Line Mapping

## Sarasota US, example Chiroptera @ 500 m altitude



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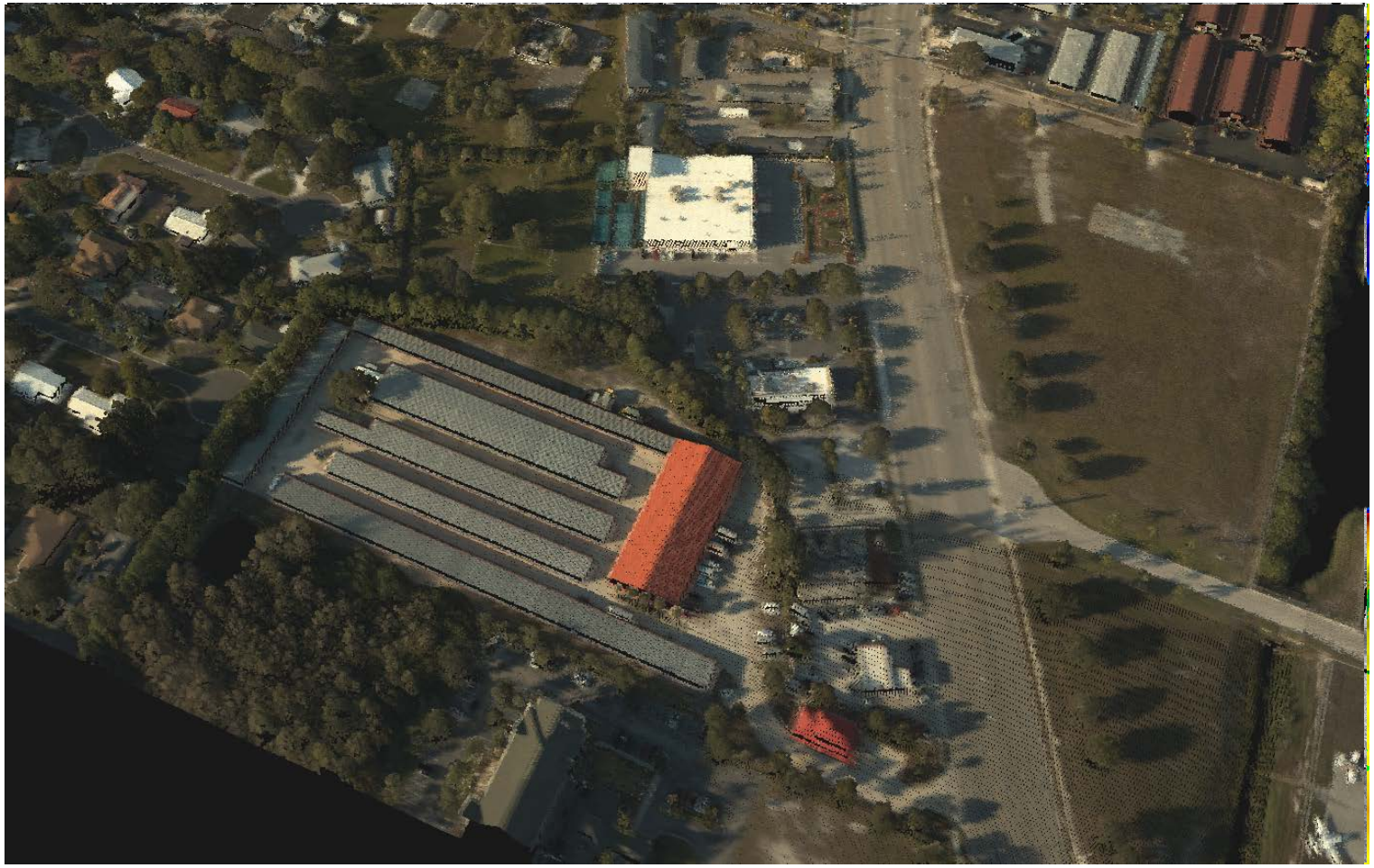
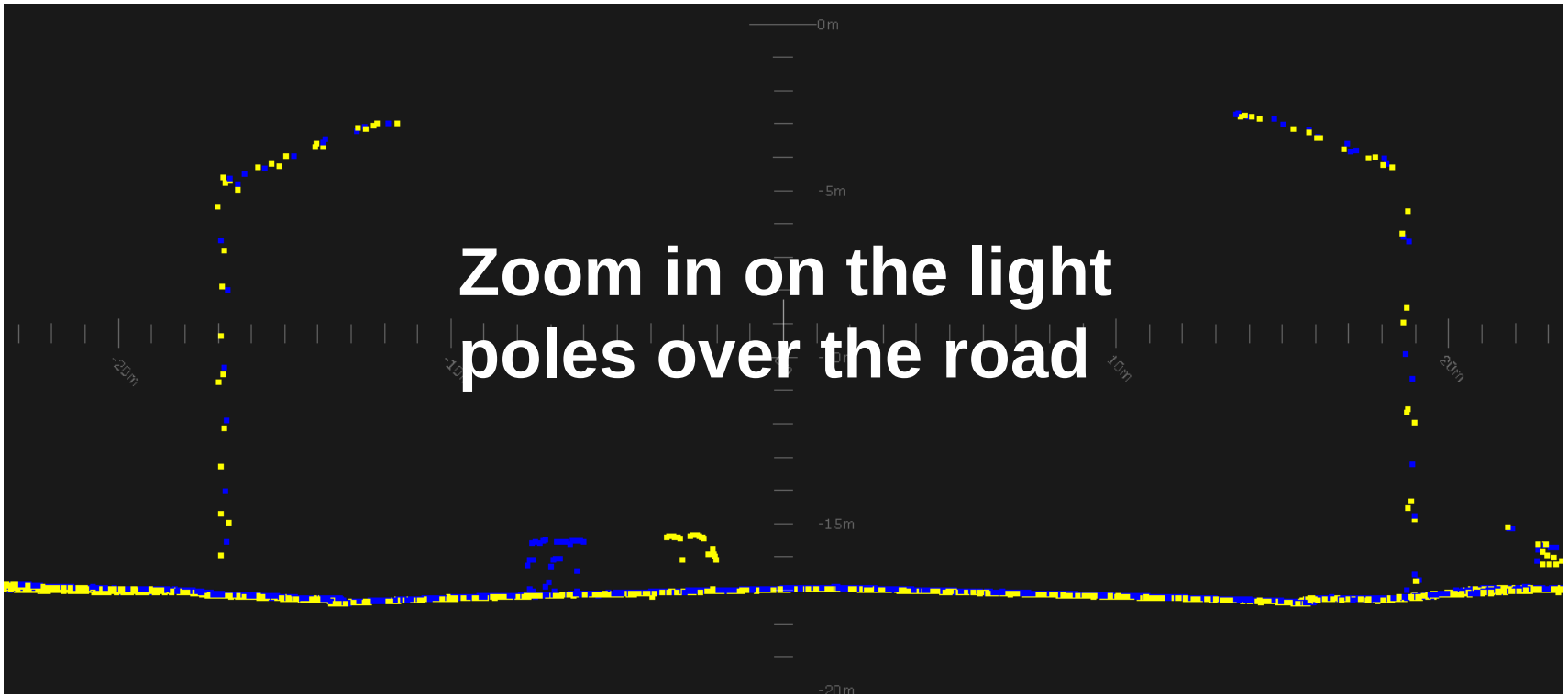
# Airport Survey

## Sarrasota Airport, US – Chiroptera @ 500 m



# Airport Survey

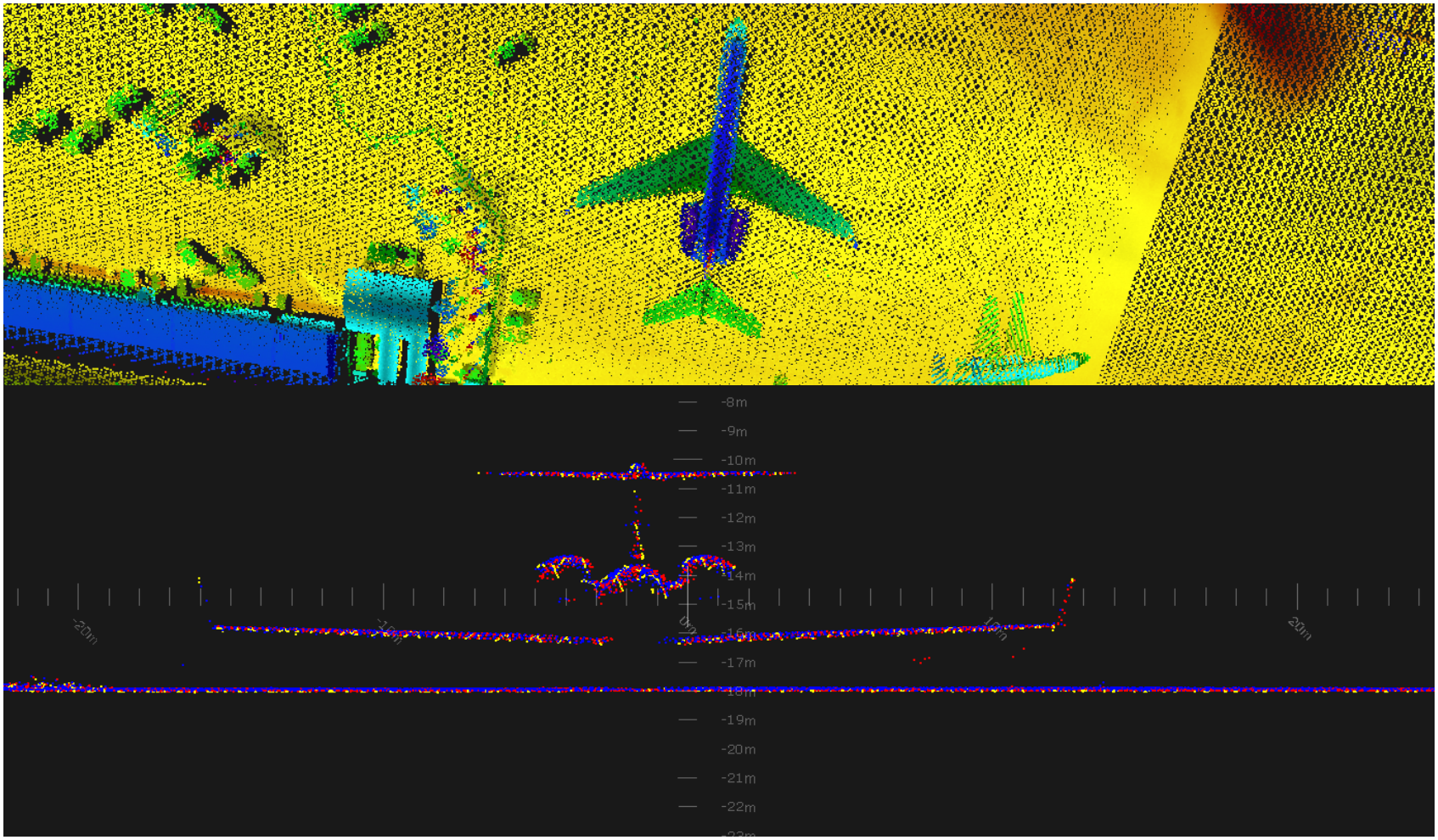
## Sarrasota Airport, US – Chiroptera @ 500 m




**Zoom in on the light poles over the road**

# Airport survey

## Sarrasota Airport, US – Chiroptera @ 500 m

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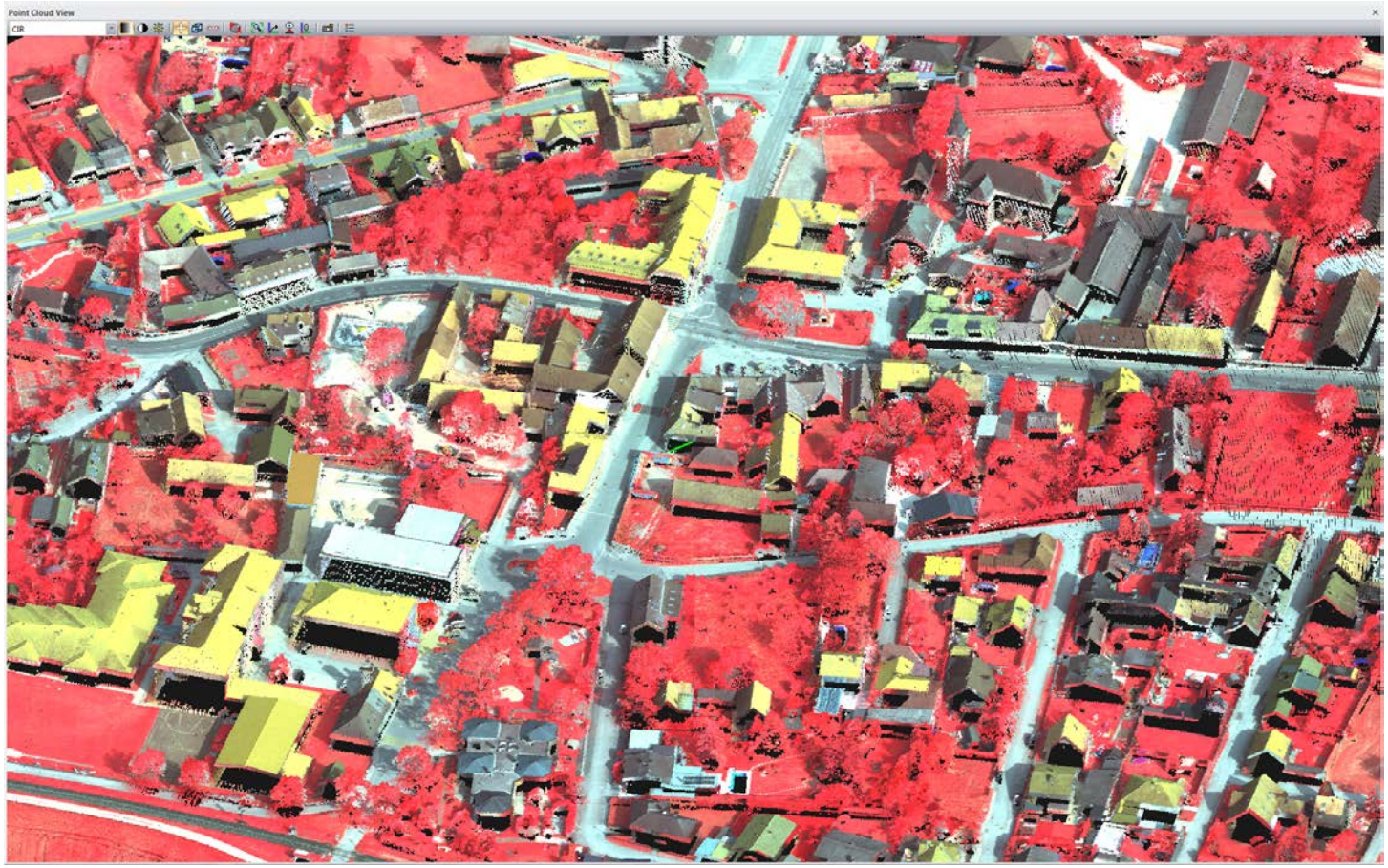
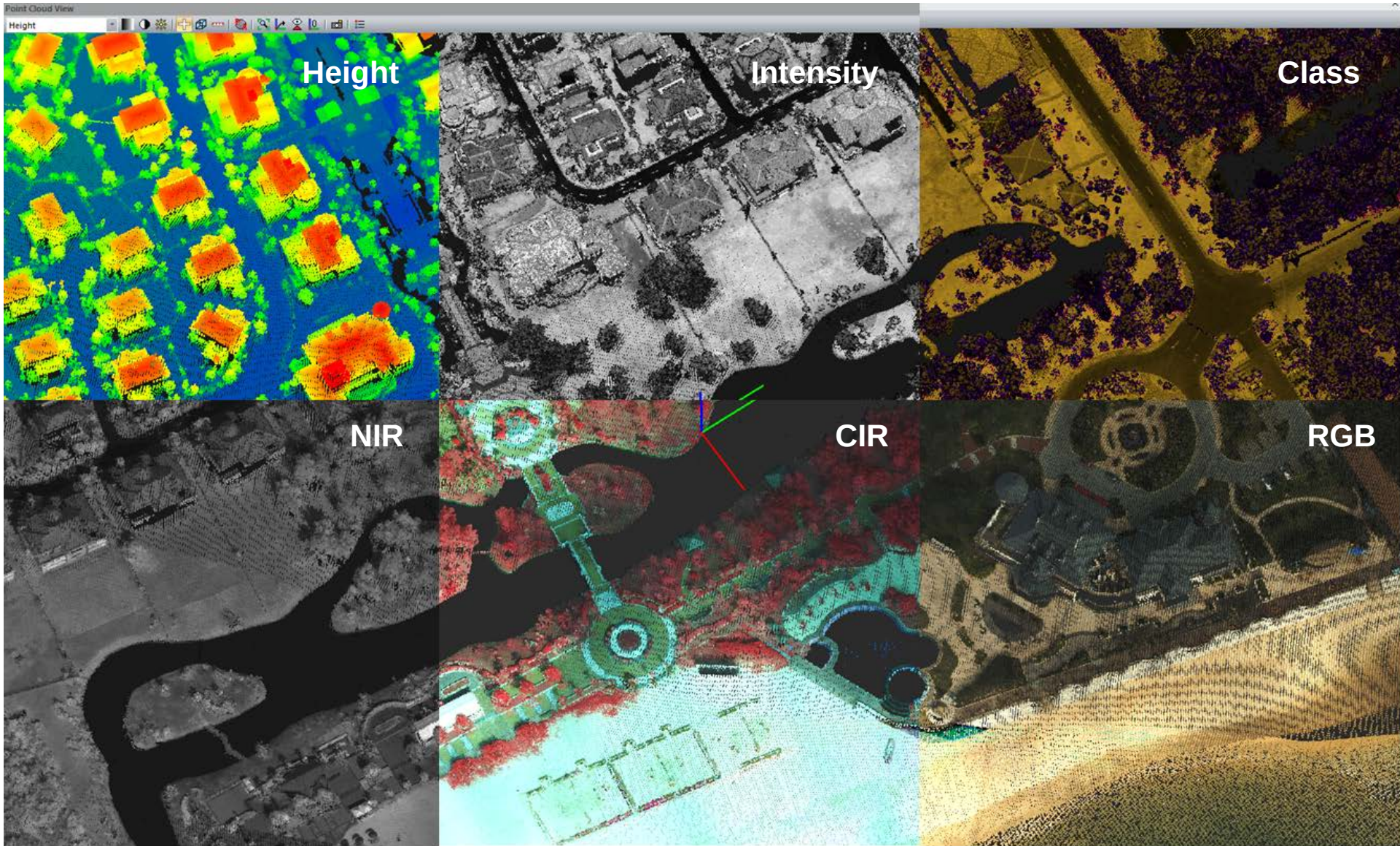
# City modelling

## Austria – Dual DragonEye



# Visualization of point clouds in LSS 2.2

## - The LSS toolbox contains multiple tools for visualization



# LSS – TerraScan Import / Export
## - improve LAS data post-processing workflow

- **Using TerraScan in Bathy Lidar processing, what is the problem?**
  - TerraScan is at LAS 1.2 , Bathy requires LAS 1.4
    - LAS 1.2 does not include nessesary bathymetric classes
      - Water surface models
      - Sea-bed
      - IHO targets
      - Near Infrared Coloring
    - When using TerraScan the connection to the bathyemtric waveform get's lost
    - TerraScan filters are adapted for topographic LIDAR, does normally delete to many IHO targets on sea-bed
- **LSS 2.2 has the solotion**
  - Import / export to TerraScan without loosing the bathymetric waveform
  - Usage of TerraScan spatial filtering, and reconnect to the waveform in afterwards



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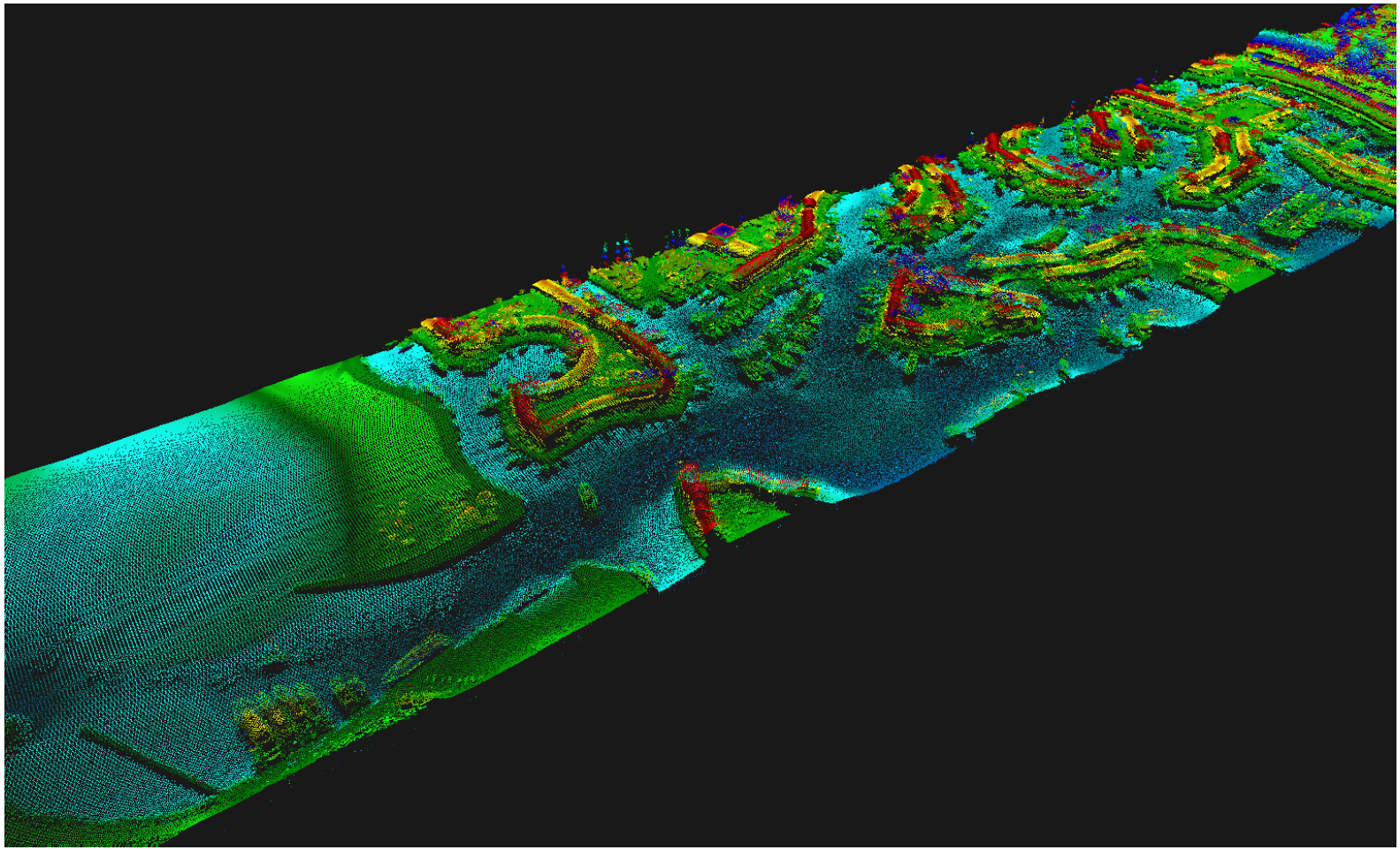
# LSS - Turbid Water Enhancement

## A significant increase of performance in difficult water conditions





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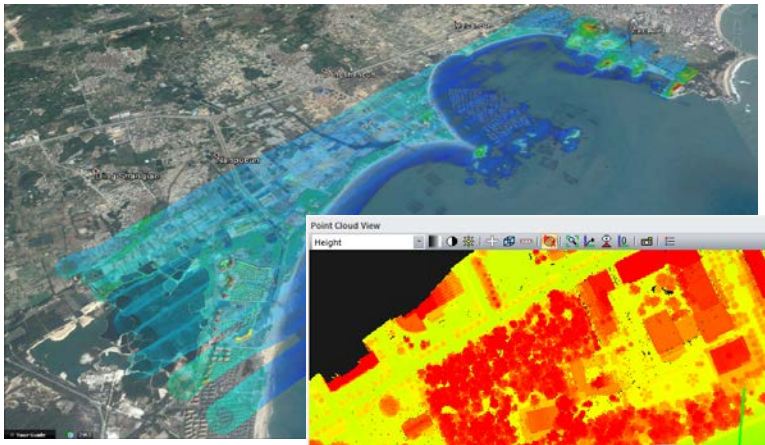
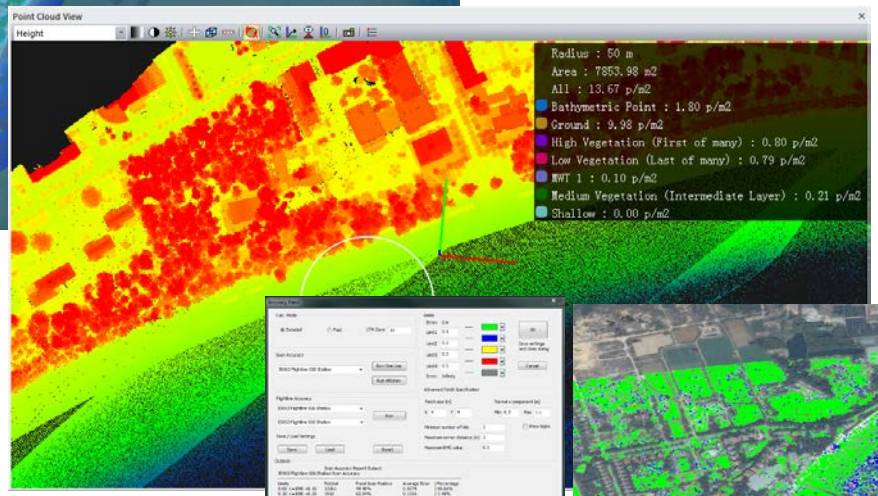
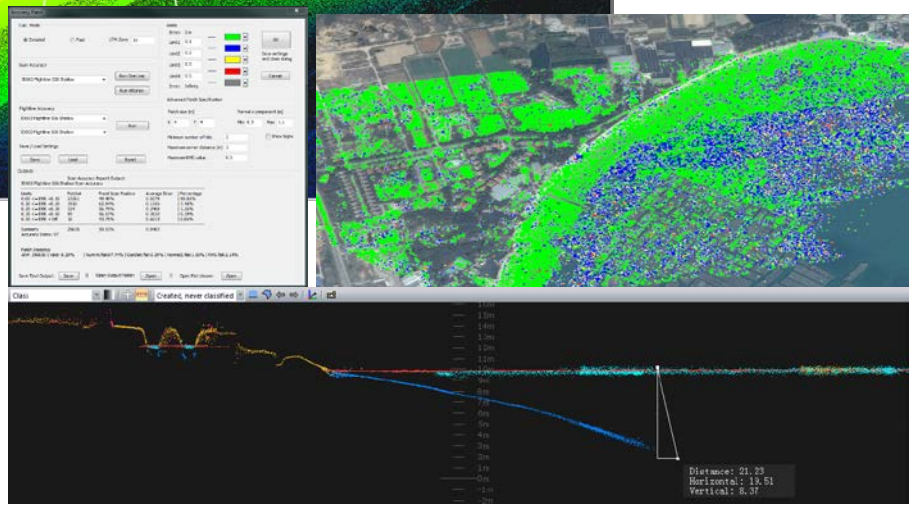
# LSS other tools



Coverage plot export
to Google earth



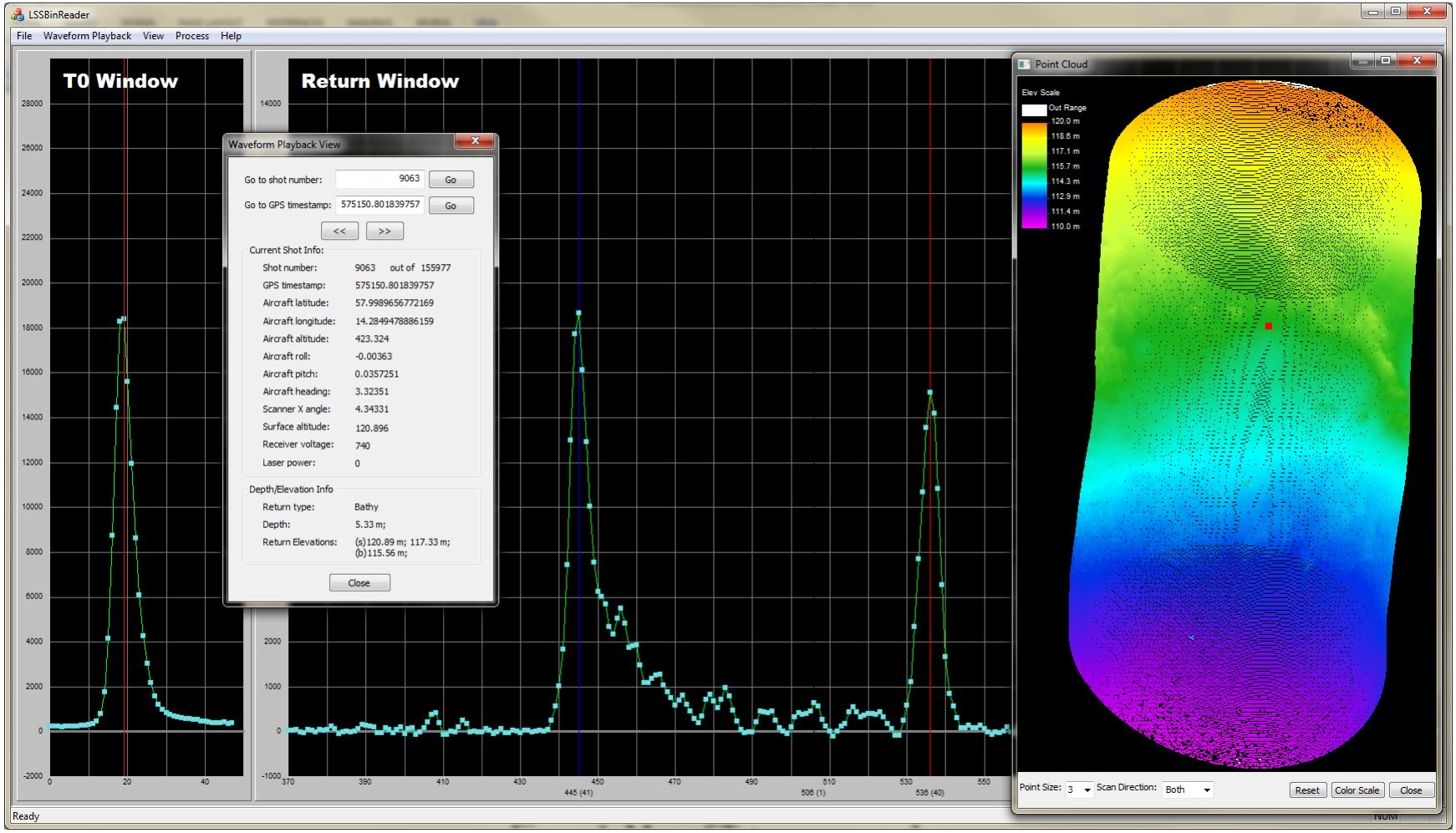

Point density tool




Quality
assurance tools

# LSSBinReader

## - Overview



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# LSSBinReader

## - General Structure

### Main LSSBinReader GUI

- ✓ **Waveform visualization & handling**
  - Waveform visualization
  - Horizontal zoom in/out, pan and reset
  - Vertical scale options
  - Waveform display features
- ✓ **Waveform playback functions**
  - Auto playback
  - Manual playback
  - Locate specific waveforms
- ✓ **LiDAR point cloud visualization & handling**
  - Color LiDAR point cloud by different properties
  - Select point types to be displayed
  - Change color scale, point size, show/hide scan directions, etc.
  - Point cloud zoom in/out, pan and individual point picking

### LSSBinReader I/O

- ✓ **File input and output**
  - Open LSS bin files
  - Output waveform data in ASCII format

### Researcher's Plugin Skeleton

**(Open Source Project)**

Skeleton of source code for a plugin to interface Main LSSBinReader GUI

- Standardized APIs
- Automatic .dll detection from Main GUI

The purpose of the plugin skeleton is to have simple interface to test new algorithms for waveform analysis and spatial analysis, within a existing framework of the waveform reader and an existing GUI



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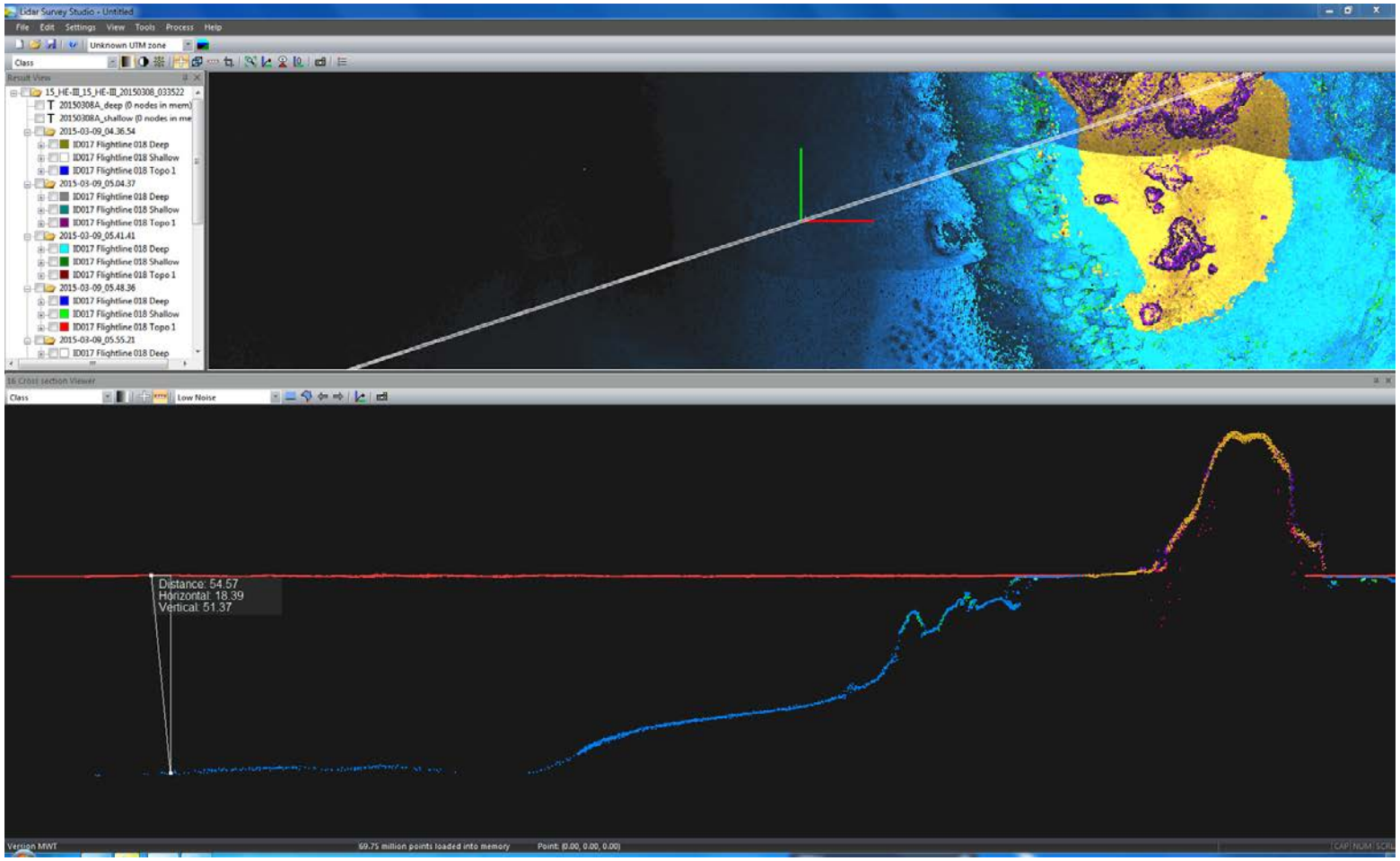
# Depth performance clear water conditions

## - Depth performance HawkEye III > 50 m @ Kd=0.08



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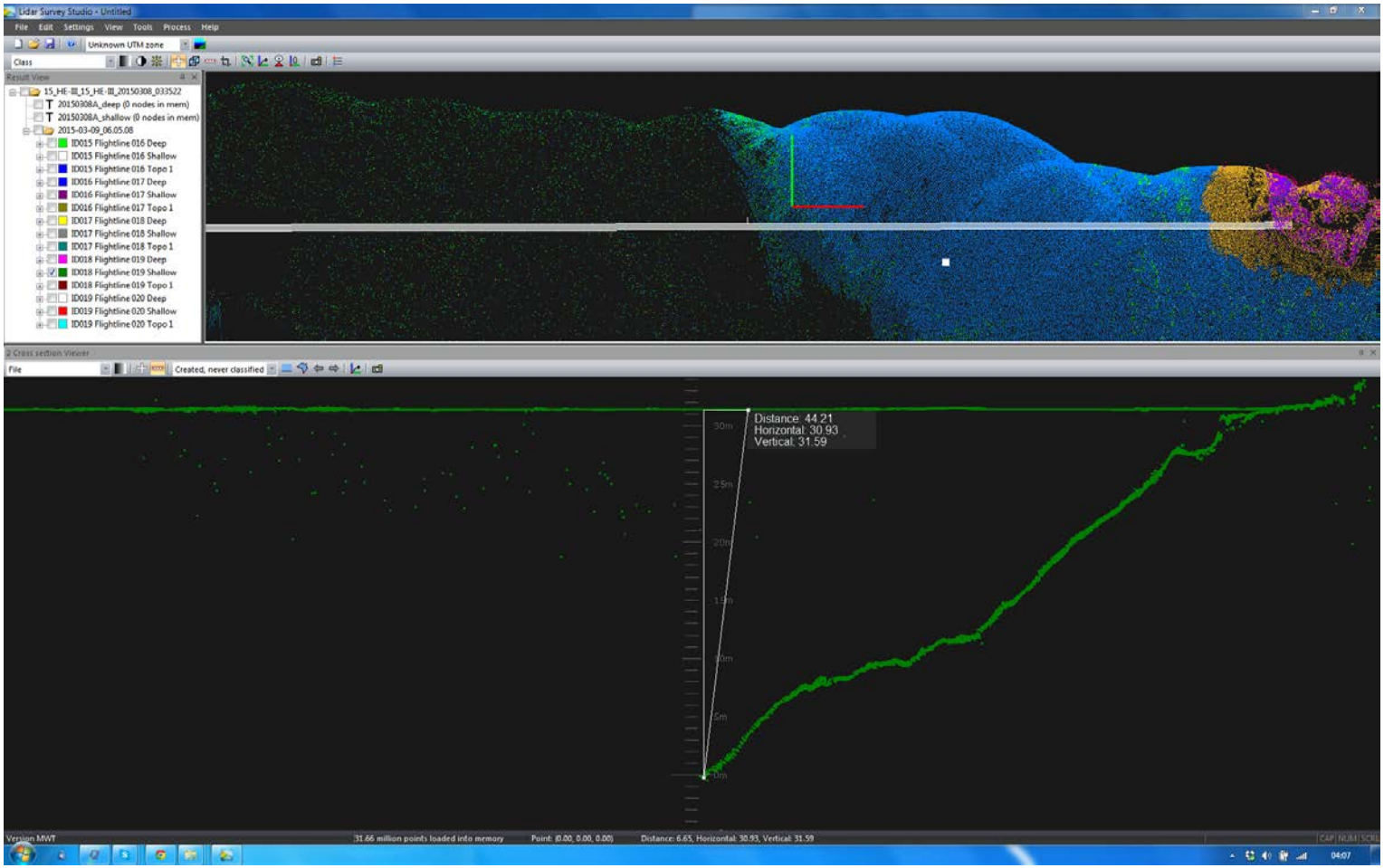
# Depth performance clear water conditions

## - Depth record Chiroptera II > 31 m @ Kd=0.08



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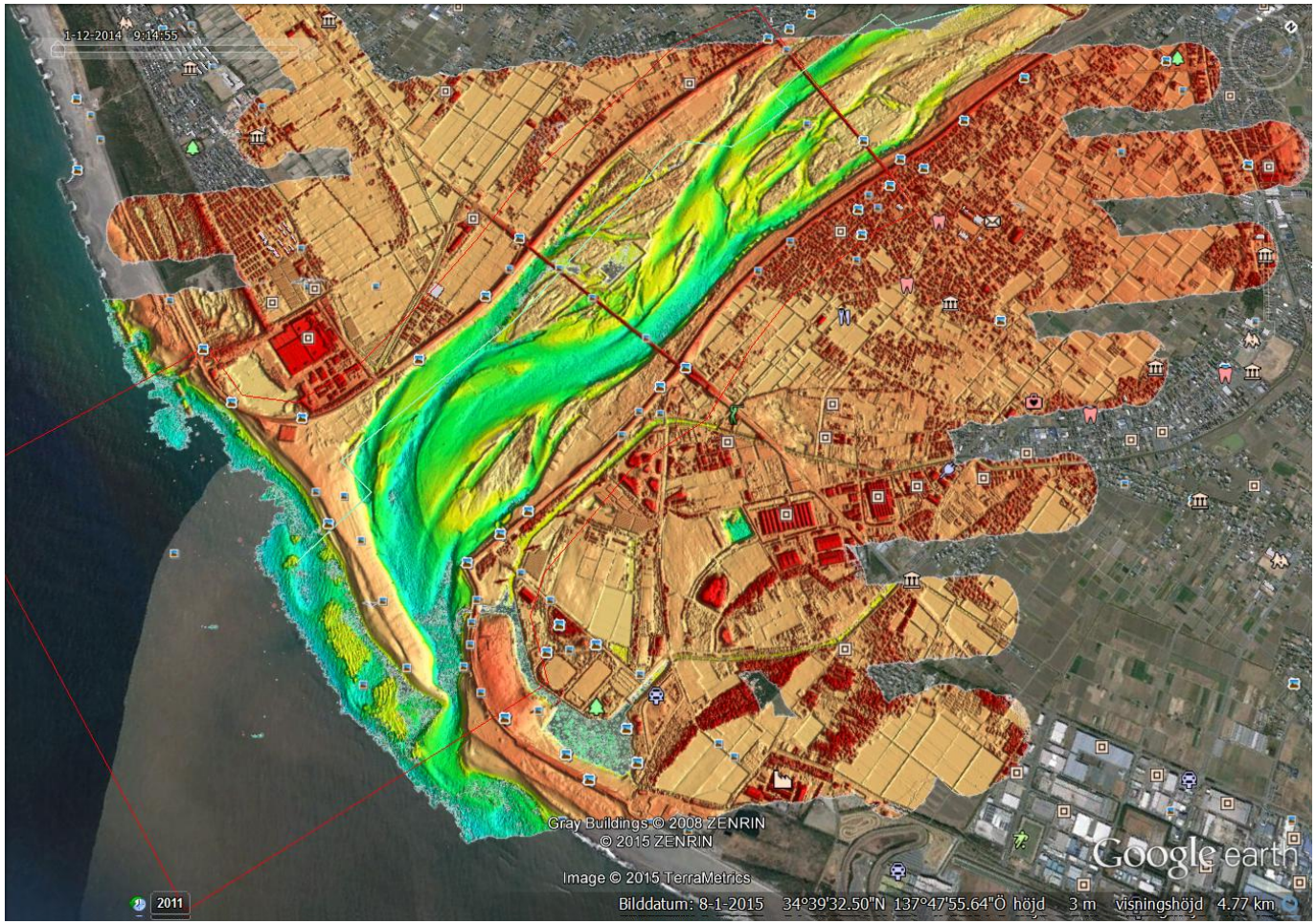
# Turbid water performance – Tanguy River, Japan

## Very Turbid Water conditions: Secchi = 1.5 m



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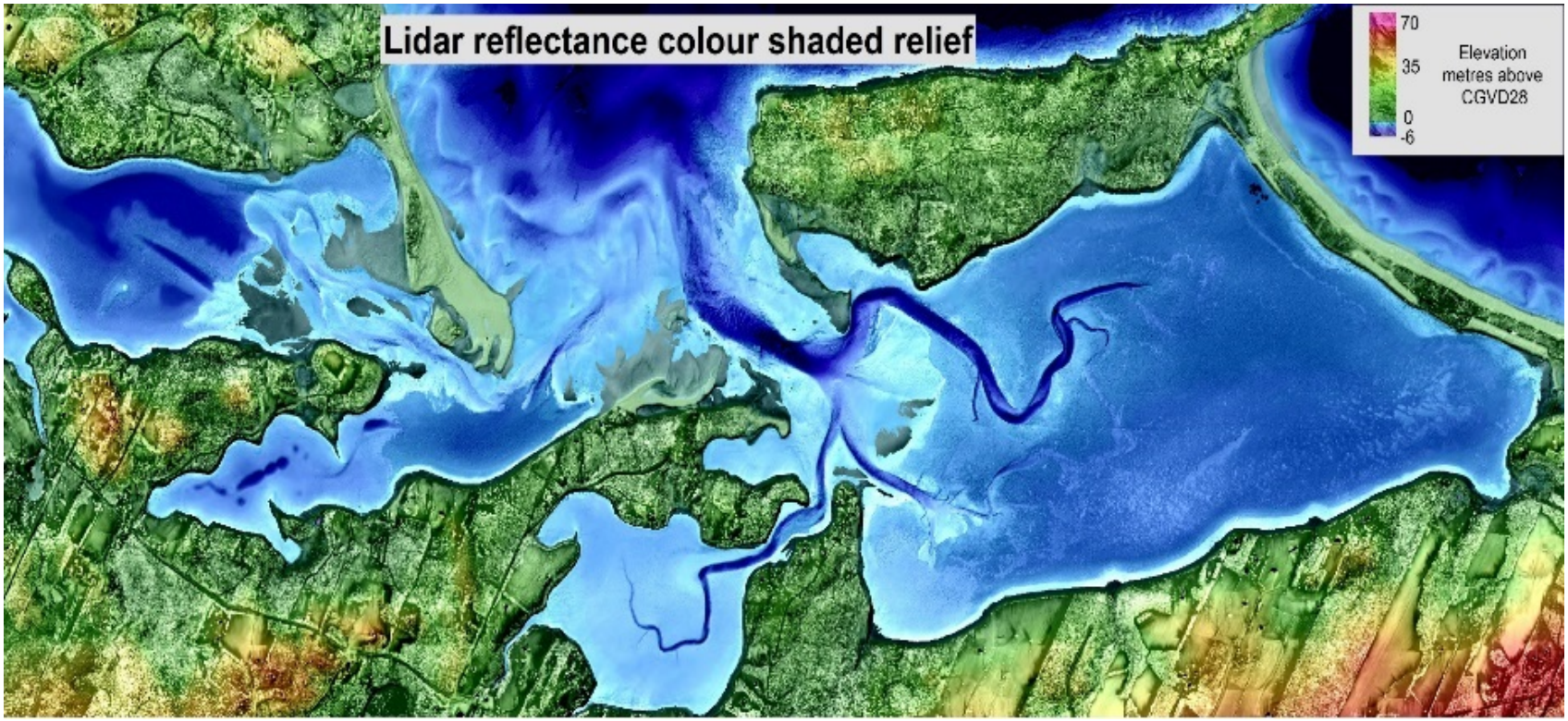
# Topo/Bathy - multiple applications

## Coastal mapping and sea-bed classification, Canada

AGRG
Applied Geomatics Research Group

Centre of Geographic Sciences
Middleton | Nova Scotia | Canada

## Nova Scotia Community College - Canada



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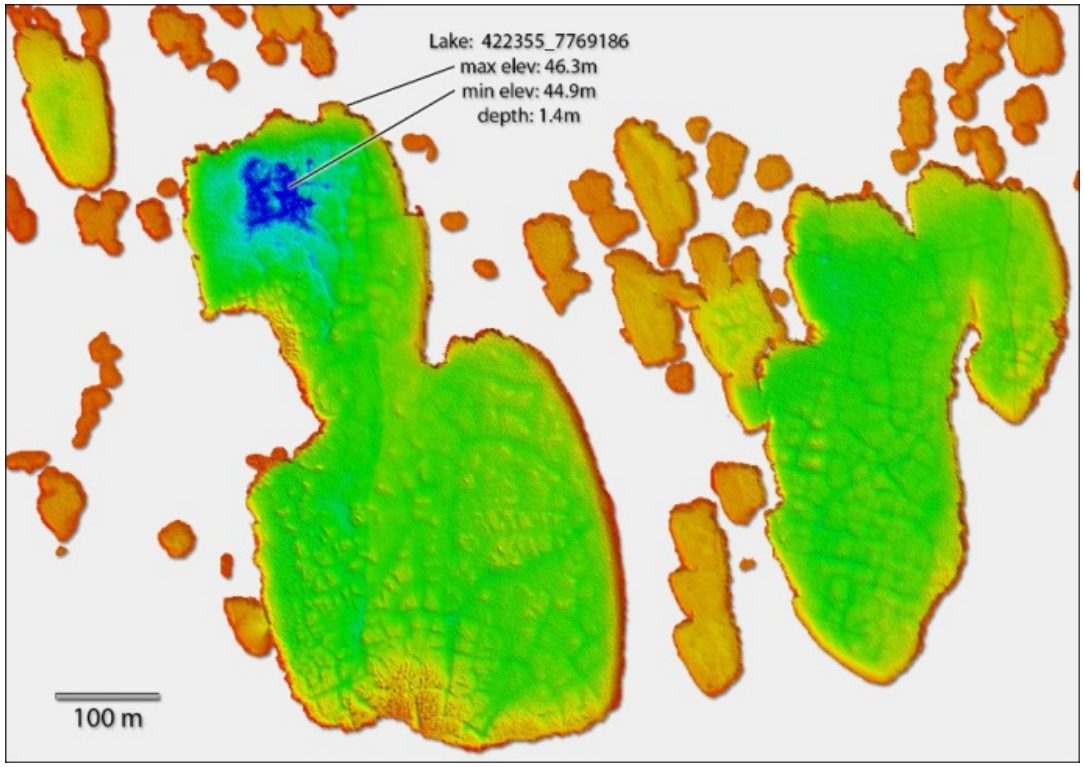
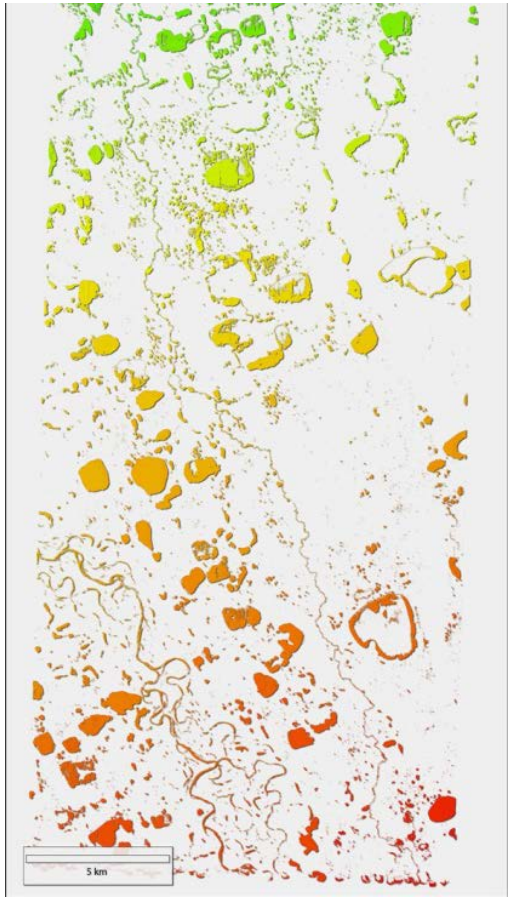
# Topo/Bathy - multiple applications

## Complex inland waters – North Slope Alaska

### Bureau of Economic Geology - Texas



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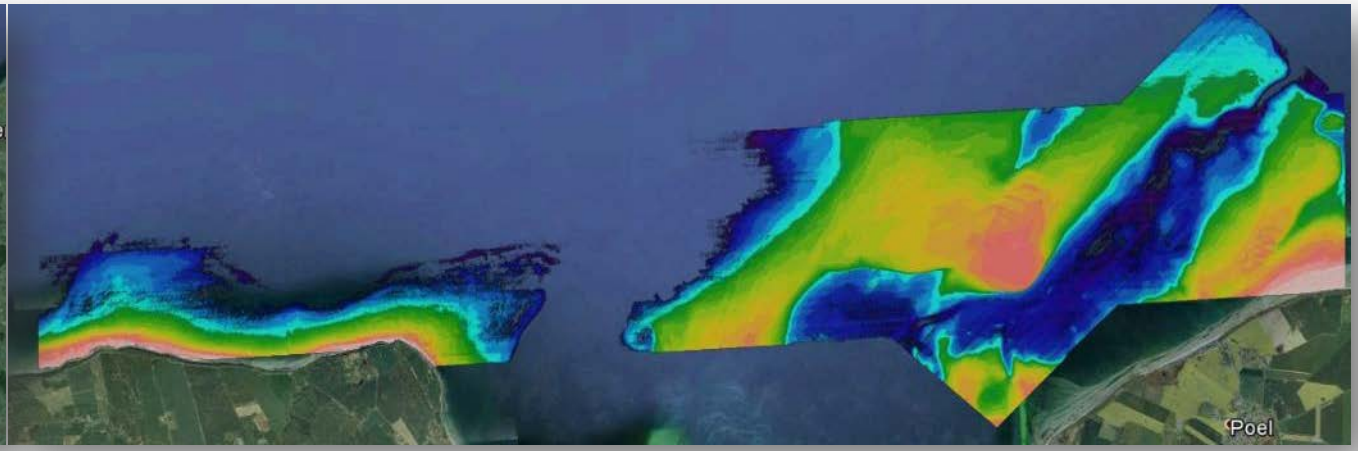
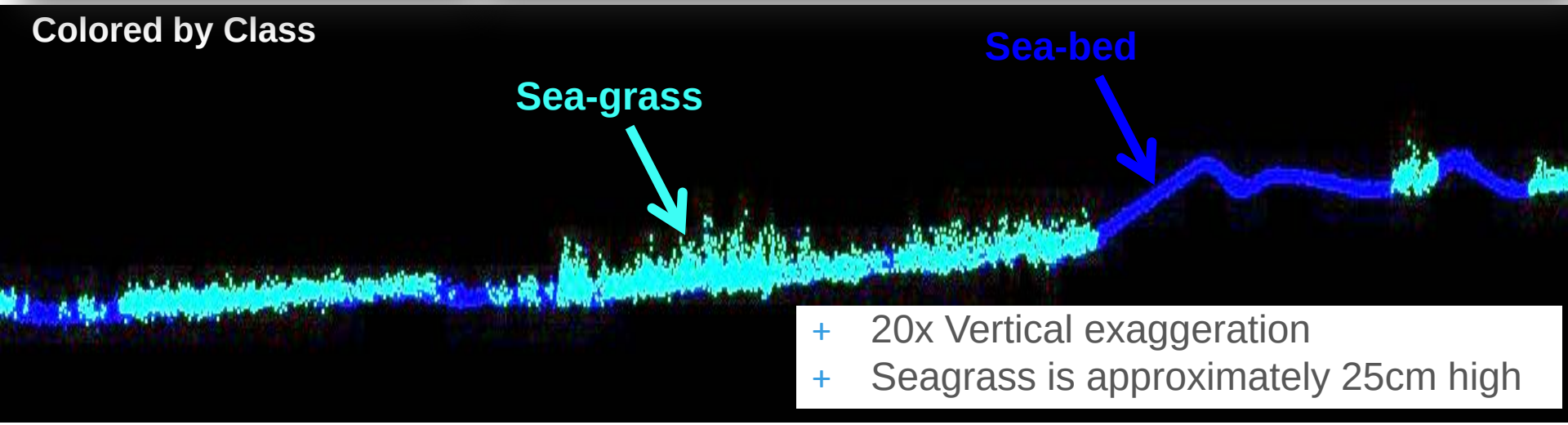
# Topo/Bathy - multiple applications

## Hydrographic Survey - Poel, Baltic Sea, Germany



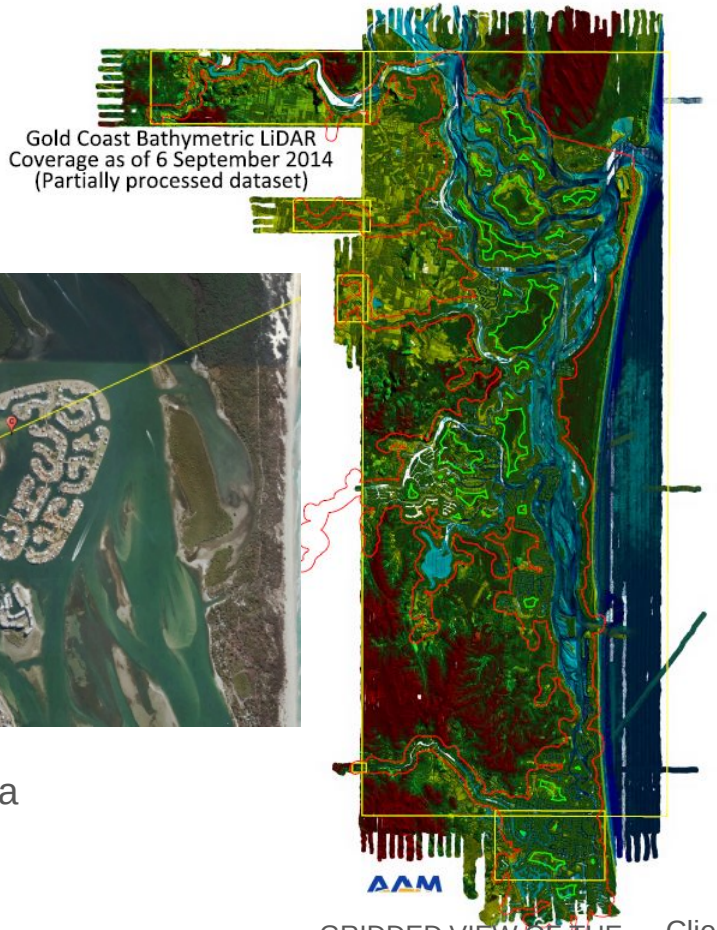




+ 20x Vertical exaggeration
+ Seagrass is approximately 25cm high

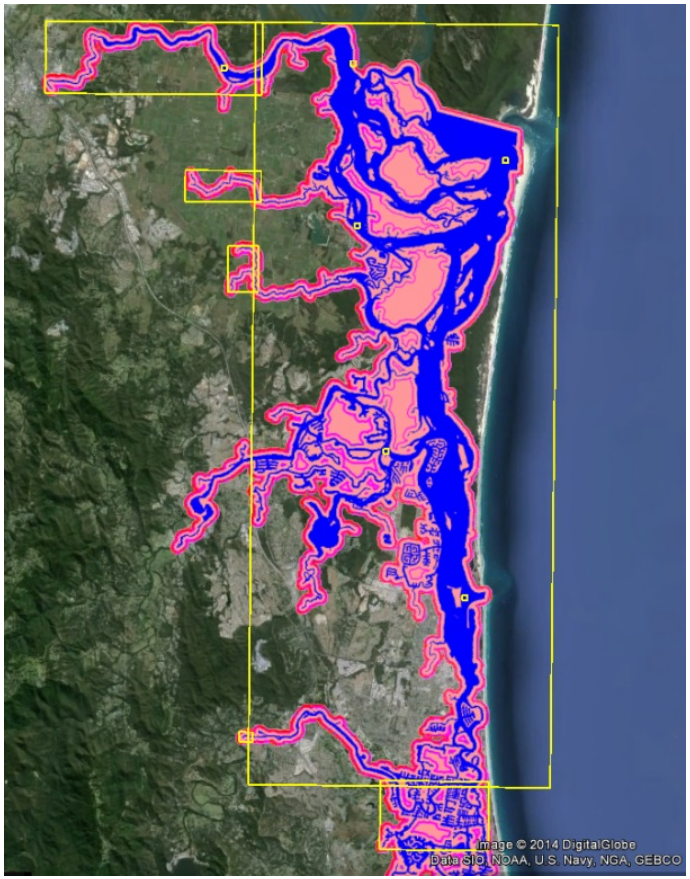
# Topo/Bathy - multiple applications

## Shallow drafted estuary – Gold Coast, Australia

Image of area




GRIDDED VIEW OF THE CHIROPETRA DATA




Client polygons for the inland waterways are shown in pink and blue

Acknowledgement to AAM PTY, Gold Coast Waterways Authority and the CRCSI

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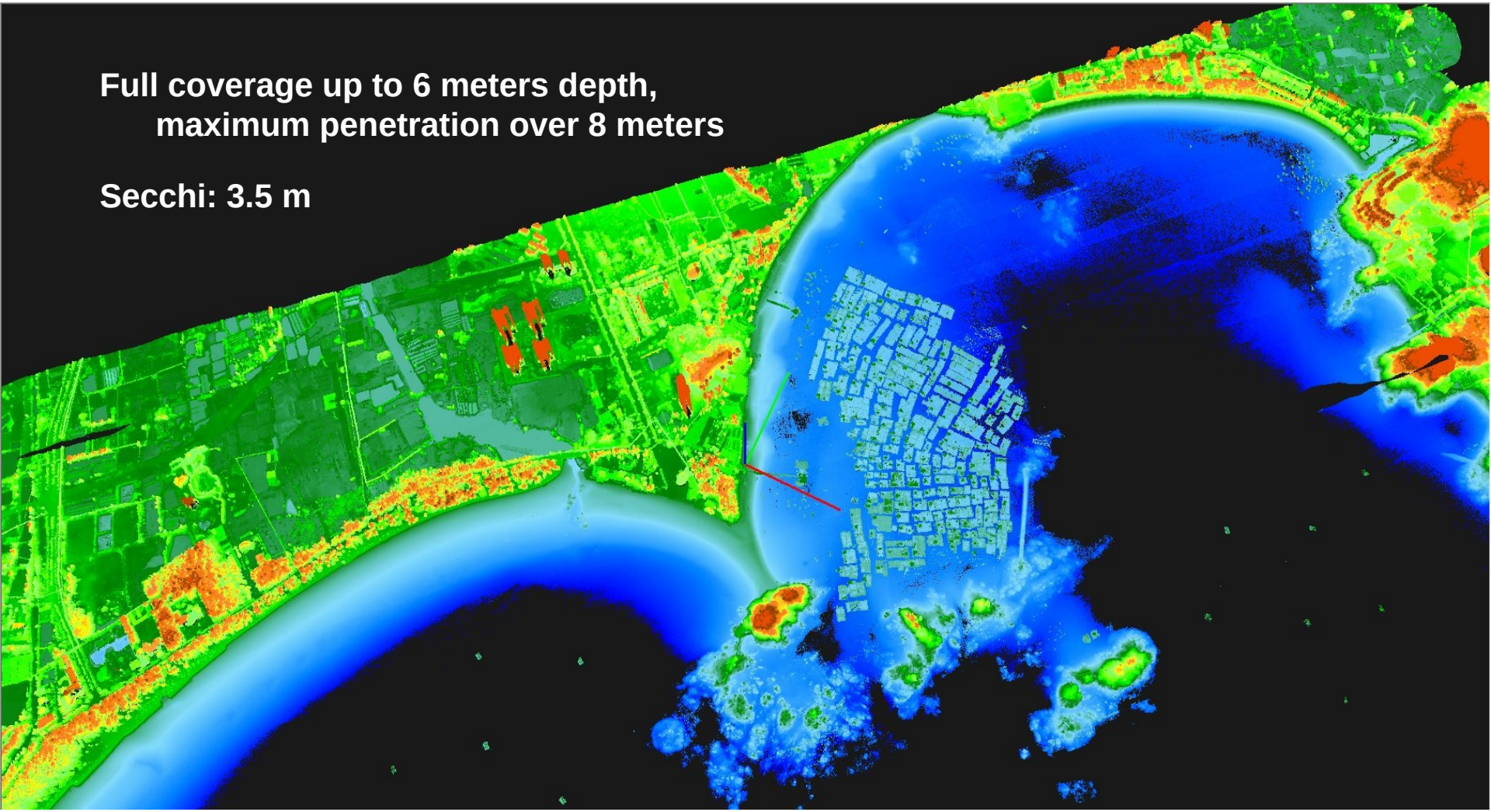
# Topo/Bathy - multiple applications

## Fish farm survey, Chiroptera II – Fujan, China



# Topo/Bathy - multiple applications

## Chiroptera shallow survey – Tampa Bay, US

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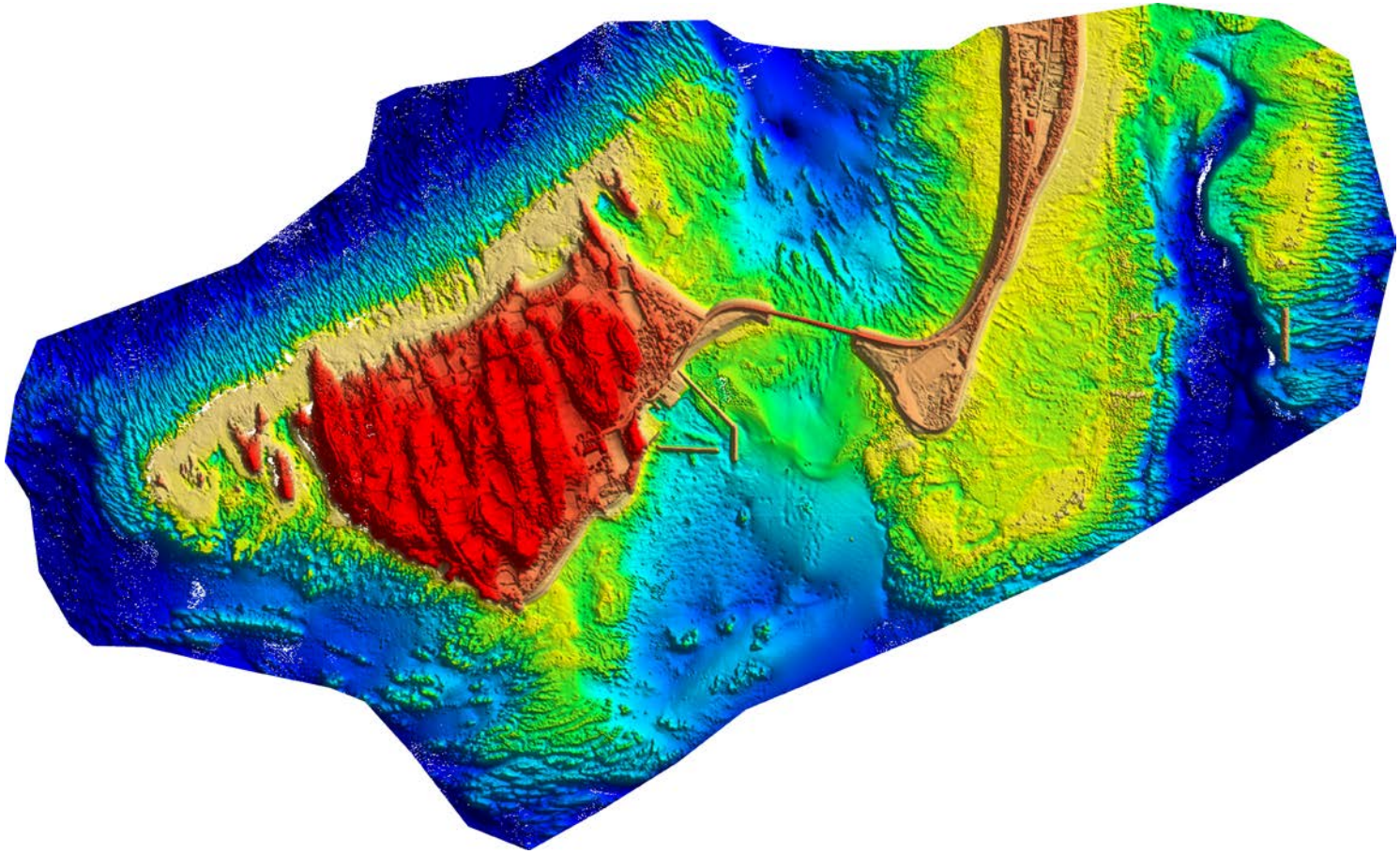
# Topo/Bathy – Multiple applications

## Island and coral reef survey – Izena Islands, Japan





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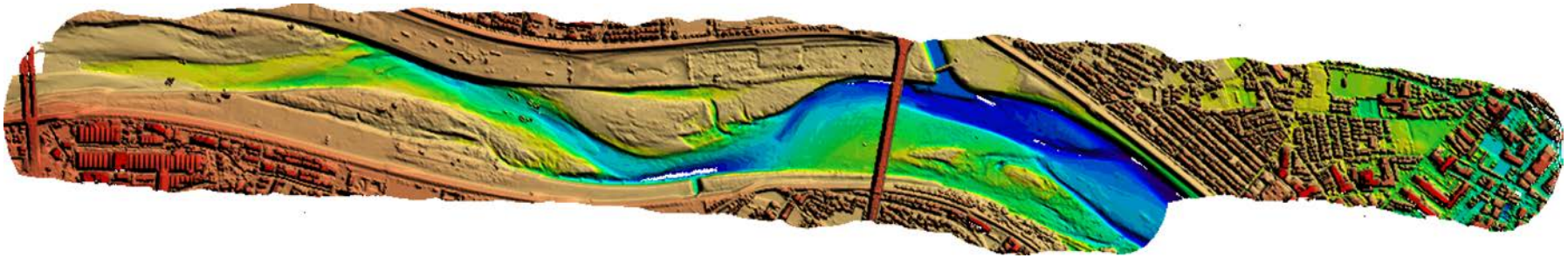
# Topo/Bathy – Multiple applications

## River survey – Tama River, Japan





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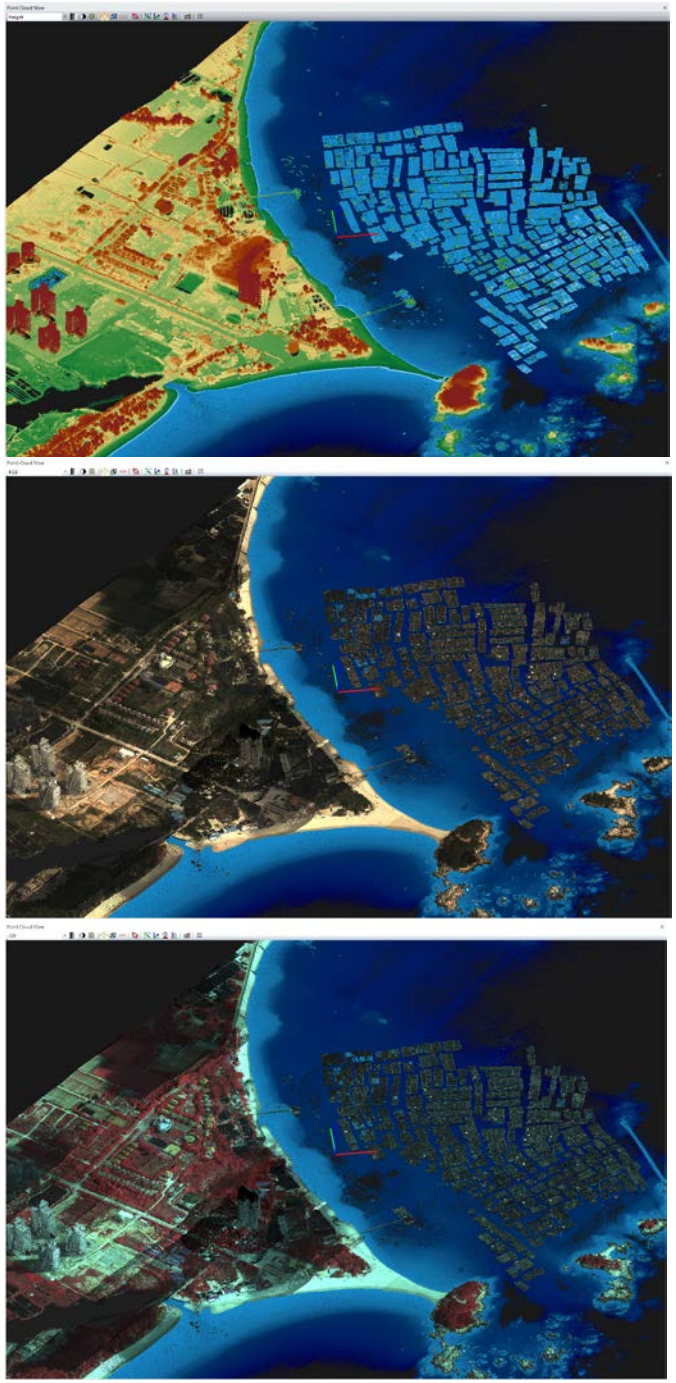
# Summary

Leica Topo/ Bathy offers a flexible portfolio adapted for collection of seamless data through the water land boundary

The systems can be used for a large number of applications, offering a high utilization and fast return of investment.

The LIDAR survey studio software suite offers a fully developed efficient topo/ bathy LIDAR workflow.

The Leica Topo/Bathy portfolio is field proven in various applications around the globe



# HAPPY MIDSUMMER!

Anders Ekelund

Leica Geosystems

anders.ekelund@leica-geosystems.com



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