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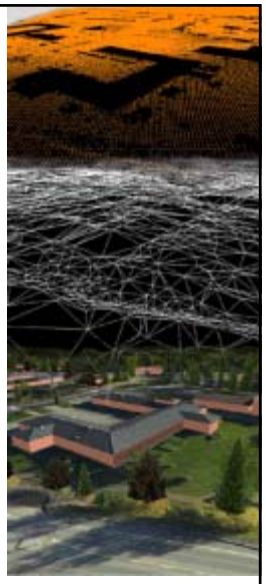
Advanced use of LiDAR data - Automatic building vectorization and contour production

FIG 14.4.2010



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Terrasolid

Terrasolid Ltd.

- Founded in 1989 – 20 years history
- Infrastructure software development and sales
- Revenues in 2009 ~ 3,5 M€
- Customers in 90+ countries
- Global market leader in airborne and mobile laser scanned point cloud processing software
- Market share around 85%
- Based in Finland

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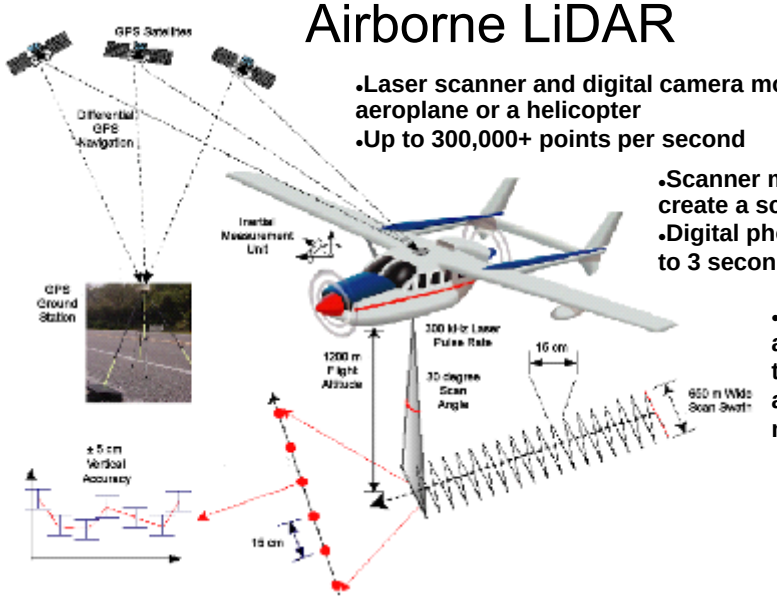
Airborne LiDAR



- **Laser scanner and digital camera mounted into an aeroplane or a helicopter**
- **Up to 300,000+ points per second**
- **Scanner mirror rotates to create a scanning pattern**
- **Digital photographs every 1 to 3 seconds**
- **Precise location and position tracking with GPS and IMU (Inertial movement unit)**

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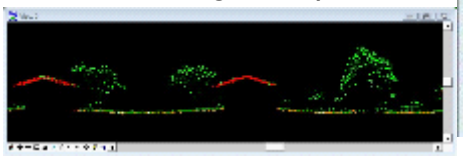
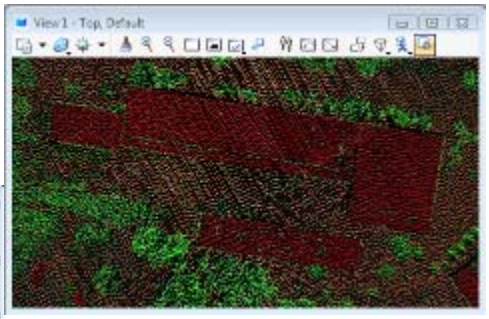
Automatic Building Vectorization

- For airborne laser data + images
- The goal is to produce approximate 3D vector models automatically
- Relies on the point cloud classification to
  - Ground
  - Height from ground
  - Buildings
- Manual editing tools provided





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Buildings & Point Density

- Higher point density → more accurate models
- Low density < 2 points / m²
  - Good models of large buildings
  - More problems with small buildings
  - Loss of detail structures
- Medium density 2-10 points / m²
  - Good models
- High density > 10 points / m²
  - Accurate models
  - Can do details

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Turku Area

- Close to 2000 km² of Finnish National Land Survey data
- 3 billion points -- 1.5 points / m² after cut overlap
- Matching of flightlines done
- Automatic ground done – no manual editing
- Automatic building classification do – no manual editing
- Automatic vectorization done – no manual editing
- Vectorization took 6 hours on notebook & USB drive

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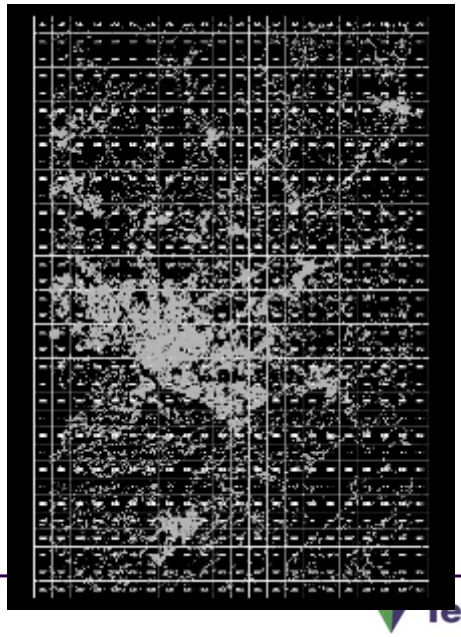
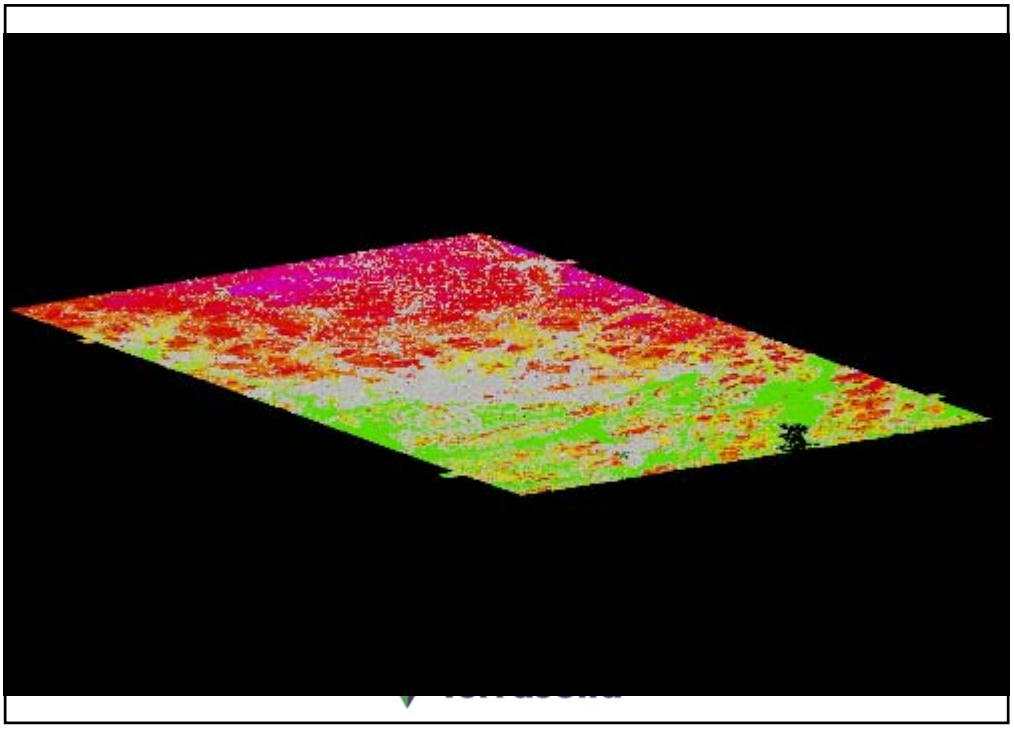
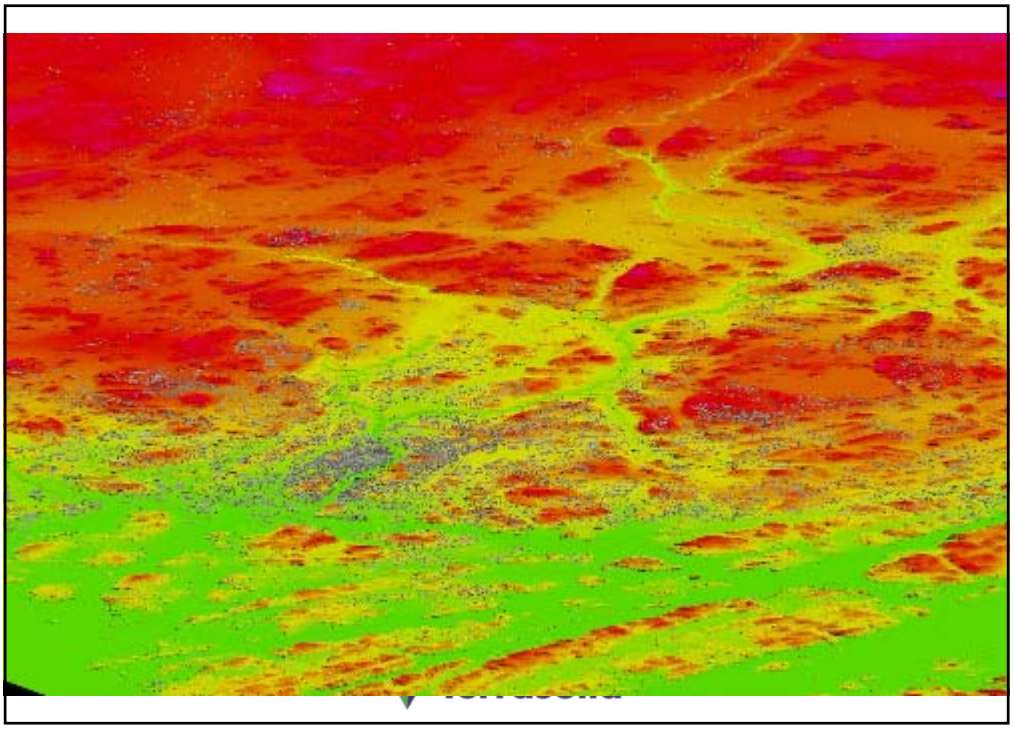
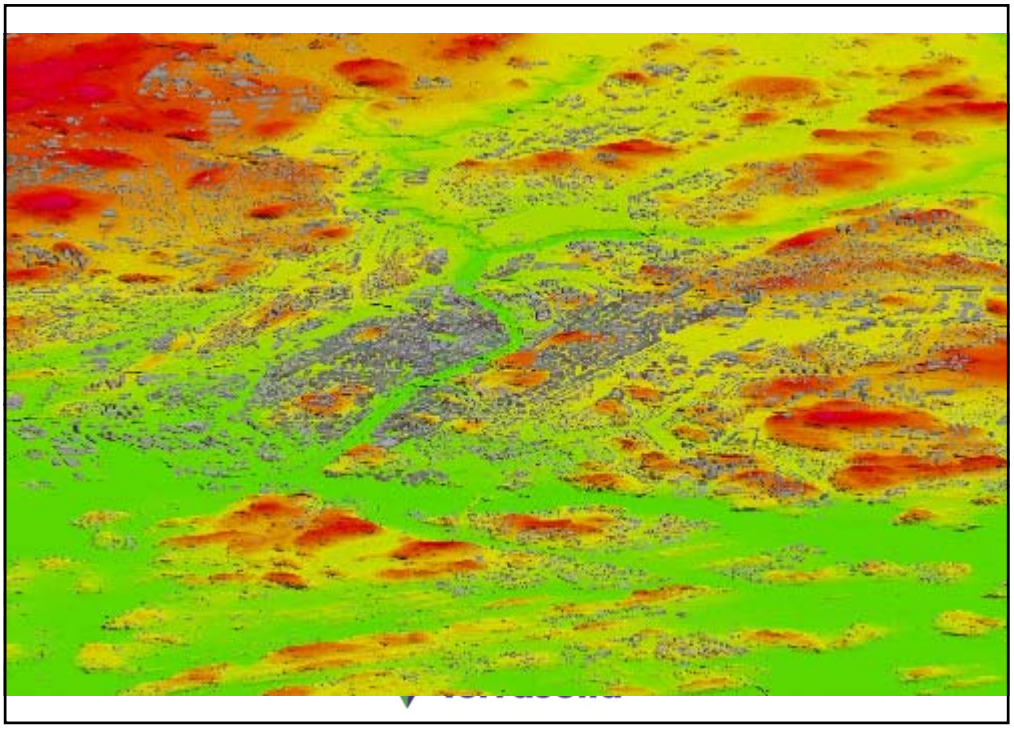
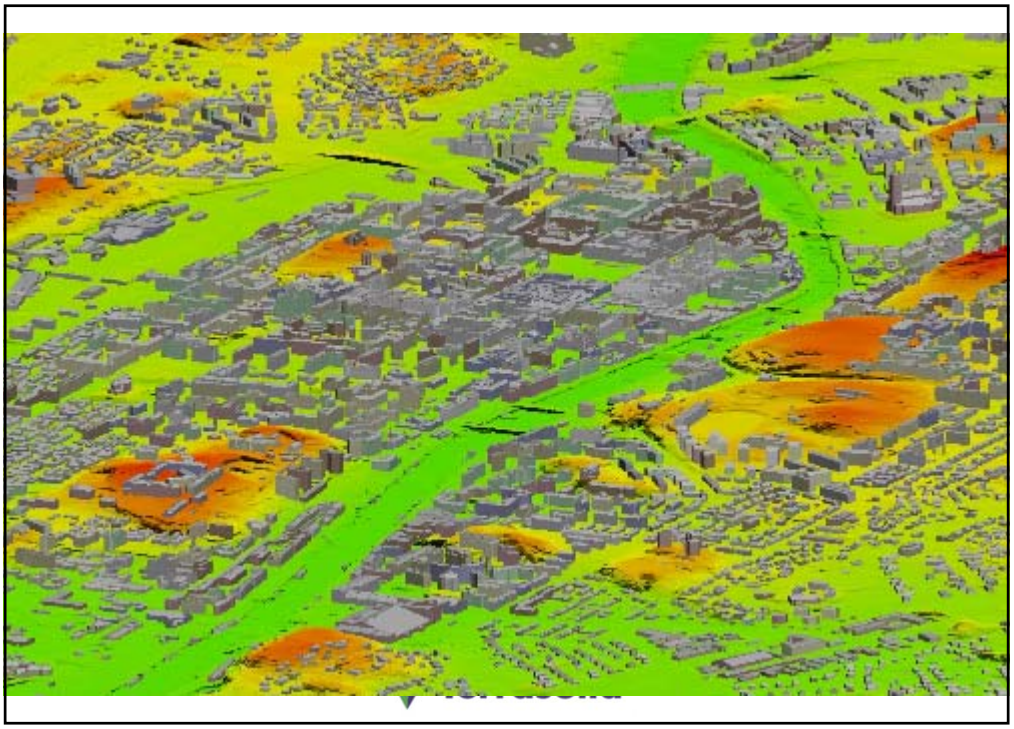
Turku Area

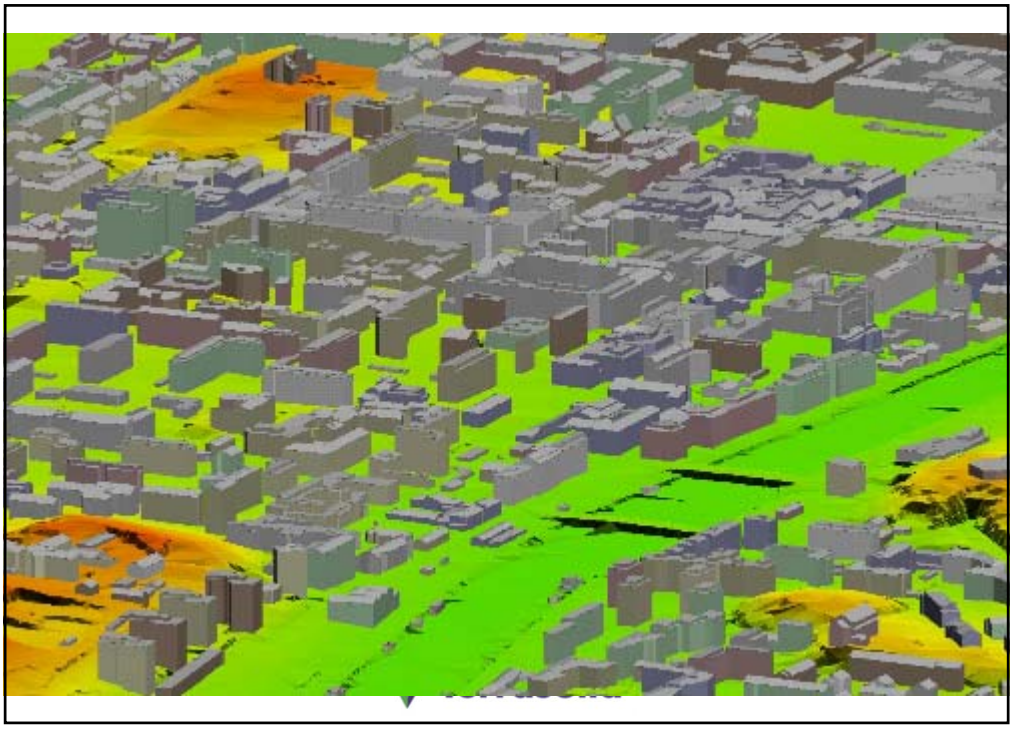


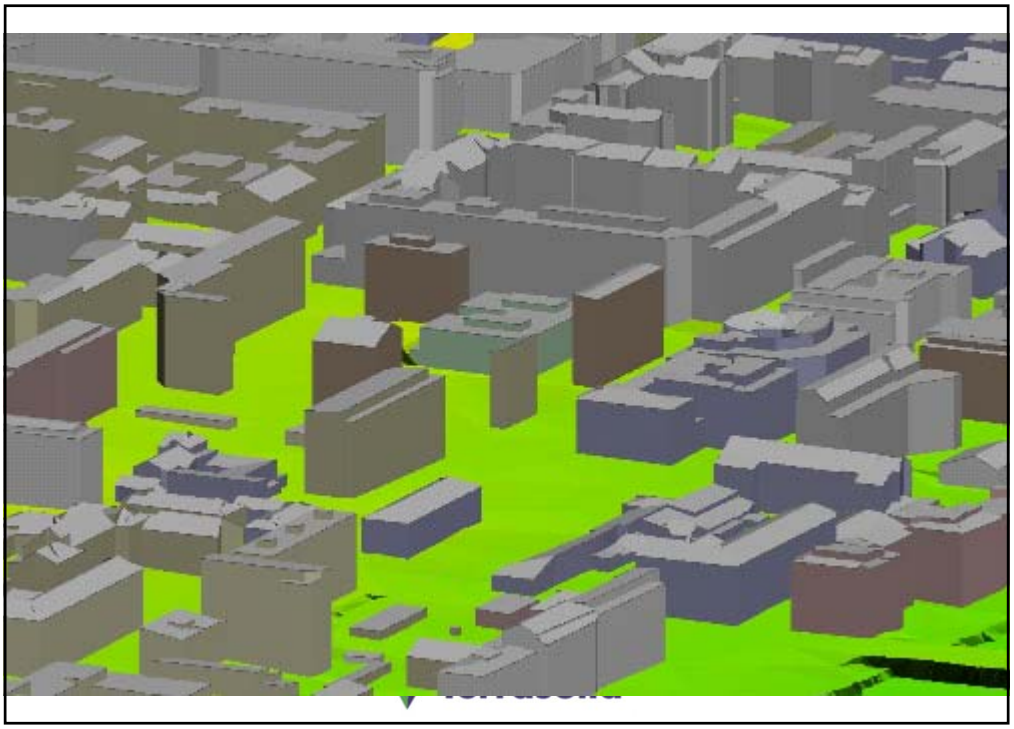












DTMs and Contours

Purpose of a digital terrain model is to:

- Pass information about terrain elevations to a computer
- Make it possible to compute quantities, draw profiles, classify laser points, visualize the terrain on screen...

Purpose of contours is to:

- Be plotted on paper
- Pass information about terrain elevations to a human

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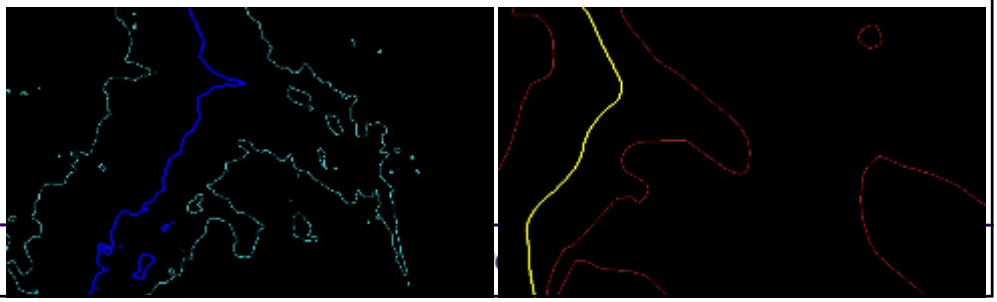
Contours

- A highly accurate model produces ugly contours
- Contours can not be accurate and pretty at the same time
- You have to balance between accuracy and prettiness when producing contours
- Bad model makes good contours !



Contours & Laser Data

Ground model from laser data is:

- Very accurate
- High density
- Is noisy – points have elevation variation

Laser data is difficult for producing contours

- Difficult to accept how bad you have to make the model to produce good contours

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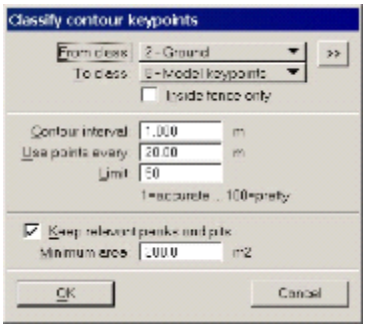
Contour keypoints

- Classification which selects points to be a ground model for contour production
- Similar to model keypoints but tailored for contours
- For smooth, nice looking contours
- User controls how big volumetric difference to true ground is allowed



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How Bad Is It ?

	Points	Avg dz
All ground points	836 069	
Model keypoints 10 cm	162 329	2.6 cm
Model keypoints 20 cm	66 270	5 cm
Smooth 10 cm, key 40 cm	18 339	10 cm
Contour key 1	813 782	0.1 cm
Contour key 13	160 737	3.0 cm
Contour key 23	64 395	6 cm
Contour key 50	14 772	11 cm
Contour key 100	3 961	16 cm

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