New solutions and highlights of INPHO software

SOVZOND VI International Conference
April. 25 - 27, Moscow 2012
Trimble GeoSpatial Products

- Extract Features & Create Geoinformation
- Image matching for digital terrain and surface modeling
- Digital triangulation, orthophoto creation and mosaicking
- Medium Format Aerial Photography
- Aerial Camera + Direct Georeferencing + Flight Management + Laser Scanning (LiDAR)
- Aerial Camera + Direct Georeferencing + Flight Management
- Trimble Aerial Cameras (TAC)
- Trimble Harrier
- Trimble DSS

Trimble Harrier
Trimble DSS
Trimble Aerial Cameras (TAC)

Software Upgrade Path
Hardware Upgrade Path
Trimble GeoSpatial Workflow Innovations

- Data Acquisition
  - Aerial Cameras
  - Airborne & Mobile Laser Scanners

- Data Processing (Inpho)
  - Ortho Photos
  - Image Mosaics
  - Elevation Models

- Information Extraction (eCognition)
  - Land Cover Features
  - Man Made Structures
  - Objects of Interest

More Value
Map Update Workflow

Aerial Survey
- Planning
  - Flight-altitude-planning
  - Flight-line-planning
  - Altitude correction of flight lines
Map Update Workflow

Aerial Survey
- Planning
  - Flight-altitude-planning
  - Flight-line-planning
  - Altitude correction of flight lines
- Survey
  - Data Acquisition
    - Harrier
    - DSS
    - Aerial Camera
  - Quality Assessment (QA)
  - Quality Control (QC)
  - Adjustment
  - Rework
Automated data processing with Inpho 5.4

- MATCH-AT: Aerotriangulation
- MATCH-T DSM: DSM/DTM Generation
- OrthoMaster: Ortho-Rectification
- OrthoVista: Mosaicking, Tiling, Color Balancing
Map Update Workflow

Change Detection with eCognition

- eCognition Server: Automatic detection of changes (cadastral map vs. aerial photography, DSM and DTM)
Map Update Workflow

Change Detection

Data Processing

Aerial Survey

Highlights of Change Detection with eCognition

- Fully automated processing
- Optional post-adjustment
Map Update Workflow

Surveying
- Field check of detected changes
- Surveying of changes (field work)
- GIS/Cadastral map update
Inpho – Data Processing

- Complete high level photogrammetric workflow
- Automatic high density surface models from imagery
- Automatic city modeling
- Mass production of seamless true orthophoto maps
Inpho 5.4: Usability & Workflow

- **Graphical analysis**
  - Easier visualization and inspection of aerial triangulation results
  - Increased efficiency for interactive quality assurance workflows
- **Point cloud viewing**
  - Higher resolution for graphical visualizations
  - Easier detection of data errors
- **Interactive editing processes**
  - Increased efficiency for
  - More intuitive to use
- **E-mail notification**
  - Monitor processing status remotely
  - Quickly respond to processing issues anytime and anywhere
Inpho 5.4: Large Data Handling

- **Parallel processing**
  - Essential workflow steps feature vastly improved performance
    - 40x faster single image adjustment
    - 35x faster global tilting
    - 2x faster region generation
    - 2x faster ortho photo generation
    - 40% faster seam lines

- **Point cloud filtering**
  - Substantial performance improvements in filtering processes
  - Simplified selection of filtering and classification parameters

- **New data formats**
  - Support of BigTiff image format
  - TPIX format support for OrthoMaster and OrthoVista
Inpho 5.4: High Density Point Clouds

- **Cost based image matching**
  - extract point clouds from images with a density of up to one point per pixel
  - Low cost alternative to LiDAR data

- **Increased downstream quality**
  - true orthophoto production benefits from higher point cloud accuracy
  - automatic feature extraction yields better results due to increased point density

- **Better performance**
  - Higher point density results in faster data interpolation
# Inpho 5.4: Highlights at a glance

<table>
<thead>
<tr>
<th>Inpho Module</th>
<th>Functionality</th>
<th>Benefit</th>
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<tbody>
<tr>
<td><strong>Match-T DSM</strong></td>
<td>Cost Based Image Matching</td>
<td>• High resolution point clouds from imagery</td>
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<td></td>
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<td>• Low cost alternative to LiDAR</td>
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<td></td>
<td></td>
<td>• Improved downstream accuracy</td>
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<td></td>
<td>Fast point cloud filtering (extension)</td>
<td>• Substantial performance improvements in filtering processes</td>
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<td></td>
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<td>• Simplified selection of filtering and classification parameters</td>
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<td></td>
<td>TPIX export</td>
<td>• Increased automation</td>
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<td></td>
<td></td>
<td>• Improved workflow</td>
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<tr>
<td><strong>Match-AT</strong></td>
<td>Enhanced visual aerial triangulation analysis</td>
<td>• Easier visualization and inspection</td>
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<td></td>
<td>• Increased workflow efficiency</td>
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<tr>
<td><strong>DTMaster</strong></td>
<td>Improved point cloud viewing</td>
<td>• Higher resolution for graphical visualizations</td>
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<td>Enhanced editing workflow</td>
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<tr>
<td><strong>OrthoMaster</strong></td>
<td>Parallel processing support</td>
<td>• Improved performance</td>
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<td></td>
<td>TPIX support</td>
<td>• Enhanced large data handling</td>
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<tr>
<td></td>
<td></td>
<td>• Improved performance</td>
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<tr>
<td></td>
<td>OrthoVista Project export</td>
<td>• Streamlined workflow</td>
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<tr>
<td><strong>OrthoVista</strong></td>
<td>Parallel processing support</td>
<td>• Improved performance</td>
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<tr>
<td></td>
<td>GUI improvement</td>
<td>• Increased efficiency</td>
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<tr>
<td></td>
<td></td>
<td>• More intuitive to use</td>
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<tr>
<td><strong>All Modules</strong></td>
<td>BigTiff data support</td>
<td>• Enhanced large data handling</td>
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<td>E-mail notification</td>
<td>• Remote process monitoring</td>
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<td>• Fast problem response</td>
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Inpho 5.4 Highlights

An image is worth a million points: Cost based image matching extracts point clouds from images at a density matching data generated by laserscanning systems.

Getting a handle on data: Parallel processing, support of data formats optimized for large datasets along with new point cloud filtering and tilting strategies deliver substantial performance improvements.

Go with the workflow: A focused investment on usability related improvements across the Inpho product portfolio result in a much improved overall workflow.
Trimble Match-T DSM

For Improved Digital Surface Model and Digital Terrain Model Extraction

from aerial images (frame and pushbroom sensors), and from various types of satellite imagery (Ikonos, Quickbird, WorldView, Spot, Landsat, IRS C/D, Aster, CartoSAT and ALOS)
MATCH-T DSM

- Satellite (RPC)
- Aerial/Frame
- Pushbroom (ADS)

MATCH-T DSM 5.4

Point Cloud in LAS format
Features MATCH-T DSM 5.4

• Resulting DSM needs less manual editing
• Significant reduction of noise in final point cloud
• More points in less processing time
• Improved results in poorly textured areas
• Better modeling of small details
Quality

MATCH-T DSM 5.3

New:
MATCH-T DSM 5.4
Data coverage MATCH-T DSM 5.3
Data Coverage New: MATCH-T DSM 5.4
MATCH-T DSM for Building Generator
Match-T DSM for direct True Ortho

- Comparison 5.3 vs. 5.4 (20cm GSD)
Fast Filtering with Inpho DTM Extension

- Filtering 1 km² in less than 1 minute
- Automatic gap filling option
MATCH-T DSM Performance test

- Test of MATCH-T DSM 5.4 version on dedicated HW platform and Windows Server 2008 R2 HPC

- Data set of the city area of Montpellier provided by company InterAtlas France
  - 1,562 UltraCam images (total 1.14 TB)
  - 9 cm GSD, 80 / 80 overlap
Distributed computing MATCH-T

Windows Server 2008 R2 HPC job scheduler

MATCH-T DSM on HEAD Node 1

MATCH-T DSM on node 2

MATCH-T DSM on node 3

MATCH-T DSM on node 4

One data volume with all images of Block
Data processing benchmark

- Point cloud 997 Million in LAS file(s) (internally 14.3 Billion points)
- 1562 images
- Case A) Running block on 1 node
  - Time to finish: 40 hours 28 min (=> 93 sec / images)
- Case B) Running block on 16 nodes
  - Time to finish: 2 hours 32 min (=> 6 sec / images)

- Factor: 15.9 (Case A / Case B)
MATCH-T DSM

- High performing DSM processing on 64 bit Windows (Vista, Win 7 and Win Server)
- Optimized utilization of hardware capacity
- Batch processing capabilities
- Easy integration into any third-party workflow

<table>
<thead>
<tr>
<th>Version</th>
<th>Elapsed Time [h]</th>
<th>Estimated Height Accuracy [m]</th>
<th># 3D Points</th>
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<tbody>
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<td>18,053,543</td>
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<tr>
<td>5.4</td>
<td>1</td>
<td>0.12</td>
<td>79,159,299</td>
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Thank You for Your Attention!

For further information please contact:

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