GeoCue for LIDAR Production

Integrated, Multiuser LIDAR Production Management System
GeoCue/LIDAR 1 CuePac Version 2011.1
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www.geocue.com

Attending Terrasolid UE, Levi 2012

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GeoCue Corporation

- Founded 2003, privately held
  - Headquarters in Huntsville, Alabama
  - Locations in Toronto, Colorado Springs, Pittsburg and Washington, DC.
  - Parent company of QCoherent Software LLC, Colorado Springs, CO
- Engineering Technology Company focused on “Integrating the Geospatial Workplace”
- Focus areas:
  - Geospatial process management system development (GeoCue)
  - GeoCue “plug-ins” to realize specific workflows (CuePac)
    - LiDAR, Digital Cameras, DEM, etc.
  - Custom development projects that use GeoCue technology as the core
  - LiDAR vertical business unit
- Staff comprises a core team of senior engineers who were principal developers of a number of leading edge commercial photogrammetry and imaging products

GeoCue LIDAR Business Unit

- Comprehensive Project Management, LiDARgrammetry and analysis software for airborne and mobile systems
- North American sales and support center for Terrasolid
  - Comprehensive suite of LiDAR edit and contouring tools
- Parent company of QCoherent Software LLC (www.qcoherent.com), developer of LiDAR tools for the ESRI® Environment
- Complete training and consulting services for Airborne and Mobile LiDAR
  - From “bootstrap” to tune-up
  - Hosting of LiDAR support on GeoCue Forum
Who Uses GeoCue?

(Software and/or Services – Excludes Terrasolid, QCoherent customers)

- 3001
- AERO-METRIC
- Atlantic Group
- Ayres Associates
- BAE Systems
- Continental Mapping Corporation
- Dawberry
- Fugro EarthData
- GeoEye
- GRW
- Harris
- HJW
- Intergraph Services Company
- James W Sewall Company
- Joint Airborne LIDAR Bathymetric Technical Center of Expertise (JALBTCX) – USACE, NOAA, US Navy
- Keystone Aerial Surveys
- Magnolia River Geospatial
- MDA Federal (EarthSat)
- Michael Baker Engineering
- Mira Solutions
- MJ Harden Associates
- National Geospatial-Intelligence Agency (NGA)
- Naval Research Laboratory
- NOAA/National Geodetic Survey
- North Carolina Department of Transportation
- Ohio Department of Transportation
- PA Dept. of Conservation
- Penn State (PA MAP)
- Photo Science
- Sanborn
- Santa Clara County
- Southern Nevada Water Authority
- Surdex
- Survey and Mapping, Inc.
- US Army - Topographic Engineering Center
- Tuck Mapping Solutions
- URS Corporation
- Wilson and Company
- Woolpert
- Helica (Italy)
- Institut Cartogràfic de Catalunya (Spain)
- Kokusai Kogyo Co., Ltd. (Japan)
- Swissphoto (Switzerland)

Competitive Advantage

- As a technology matures, early adoption and functional differentiators tend to disappear as a competitive advantage.

- When a ‘common’ process methodology emerges, competitive advantage moves to the organizations with the better managed processes.
GeoCue has solutions for what keeps you up at night

- Are you efficiently managing your hardware and software deployments… Local Cloud Processing?
- Do you know the real status and cost of projects?
- Do you lack insight into nodes of production inefficiency and roadblocks?
- Do you know the bottom-up cost of delivering on your commitments?
- Are you constantly reinventing the wheel on new projects?
- Is product quality inconsistent?

These are just some of the common problems that geospatial production companies encounter, all of which result from inconsistent or nonexistent workflow management and tool deployment.

**With GeoCue, you can start to sleep at night**

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Why integrate with GeoCue?

- **Efficiency**
  - Creates a consolidated work environment; a unified geospatial production kiosk
  - Easily manage distributive processing (local cloud) – make the most of available hardware and software resources
  - Repeatable workflows (no reinventing the wheel on projects – lower project startup costs)

- **Accuracy**
  - Workflow driven
  - Repeatable processes and products
  - Anticipated quality levels / workflow with required production steps
    - Quality Control - no embarrassing “Premature Deliveries”

- **Reporting**
  - Elements of a project/workflow can be tracked
    - True costs can be computed/tracked (database w/SOA)
    - Ability to accurately assess level of effort required / improved cost estimating metrics as result of tracked production components

- **Extendable**
  - Enterprise solution for geospatial workflows
  - Extends cross-training opportunities
  - Provides mechanism for scalable project elasticity (efficiently manage increased resources on large “windfall” projects)
GeoCue Product Family

- Scalable enterprise geospatial production framework product family
- An extensible (including separate physical production facilities, subcontractors, etc.), fully integrated environment for encapsulating large geospatial production flows into a controlled, real-time process management framework
- Products are designed to integrate data, multi-vendor applications, and users into a comprehensive and controlled multiuser system
  - Integrates existing technology
  - Maximizes use of current processes
  - Enables advanced distributed processing (local cloud)
  - Provides real-time Earned Value Management statistics
- Are cognizant of management structure: Technician → Production → Project → Executive
- Makes geospatial production faster, more organized, and more accurate

Why integrate with GeoCue?

- Easy
  - Simple to use graphical interface built specifically for geospatial work production
- Fast
  - Scalable workstation and server deployments with cloud processing options
- Powerful
  - Geospatial workflow and process manager for consolidating and launching disparate geospatial/processing applications

GeoCue solutions make geospatial production smooth, predictable, efficient, and more profitable
What is GeoCue?

- Workflow management tools for both production operators and production managers.
- Extensible framework for large volume, multiple production seat geospatial data production shops.
- Combines multiple data sources into a managed project data set.

A shell that integrates your existing tools into a single efficient, manageable environment.

GeoCue supports technology growth through production tools supplied by GeoCue Corporation, other software companies, or by integration of the client’s own in-house tools.

Client-Server Architecture (Windows .NET)

- GeoCue Server
- GeoCue SOA Server (Dashboard)
- GeoCue Project Portal (Web Map View)
- Database (SQL Server)
- Distributed Data Storage
- Remote Dispatch Node - UNIX
- Remote Dispatch Node - Windows
- CuePacs or User Defined Environments
- Web Client
GeoCue with LIDAR 1 CuePac

- Comprehensive multiuser environment for processing LIDAR data
- Accepts data immediately after geocoding (e.g. from ALSPP, Dashmap, LMS)
- Integrates existing tools (e.g. TerraScan) into a cohesive, multiuser workflow
- Provides a data access control and monitoring layer that significantly improves product quality
- Includes application specific tools to enhance productivity such as LIDAR Stereo and visualization images
- Seamlessly integrates into the Distributed Project Management System for managing Prime-Subcontractor workflows

FMAS CuePac

- LIDAR Horizontal Accuracy Assessment and Correction System (FMAS)
  - Original project for the Ohio Department of Transportation
  - Developed by GeoCue with advisement from ODOT, Ohio State University and USA Topographic Engineering Center (TEC)
  - Product is used to assess and correct horizontal positioning of LIDAR for engineering scale work
MMS CuePac

- Extends GeoCue production to the Mobile Mapping domain
- Initial workflows are focused on the Optech LYNX system
- Provides additional features needed for importing and managing multiple laser scanners and digital cameras

Multi-Contractor Management

- Distributed Project Management System (DPMS, Project Portal)
  - GeoCue-based system for managing projects that are being conducted by geographically dispersed project teams
  - Jointly funded by GeoCue and URS Corporation
  - Is currently deployed on two major projects
    - Florida Coastal Mapping (FDEM)
    - Pennsylvania State-wide LIDAR/Ortho project (PA MAP)
LIDAR “Bootstrap” Program

• Complete Software and Training program for companies entering the LIDAR processing business (airborne or mobile)

• Software
  – GeoCue with LIDAR 1 CuePac
  – Mobile Mapping CuePac
  – TerraMatch (Geometric Corrections)
  – TerraScan/TerraModeler (editing)
  – LP 360 EQC (LIDAR QC, light editing)

• Training
  – Data Input and Project Creation
  – Geometric analysis and correction
  – Automatic classification
  – Interactive edit
  – QA
  – Data Delivery

GeoCue for Managing Your Terrasolid Based LIDAR Production
Basic LIDAR Production Workflow

Data Collection
- Flight Planning
- Ground Survey Support
- Aerial Data Collection

Preliminary Processing
- Download/Upload Raw Data
- Data Integrity Check
- Process GPS/IMU Data
- Georeferencing of Laser Data

Data Processing
- Project Initialization
  - Initial QA/QC (Coverage, Preliminary Accuracy Assessment)
  - Calibration/Validation (Geometric Correction)
  - Classification of Laser Data (Automated Processing, Interactive Analysis)
  - Final QA/QC (Interactive Editing, Reclassification, Accuracy Assessment)

Product Generation
- Surface Modeling
- Feature Extraction
- Contour Generation
- Imagery

Import LIDAR data from Dashmap/ALS
Context Data

Link to Google Earth™
Import GPS/IMU Data (SBET/SOL)

Quickly Create Trajectories
Comprehensive Project Layout Tools

LAS Data Filters
Define Output LAS Products

Transform Data (including Geoid)
Rapidly Visualize Project Coverage

Synoptic dZ Accuracy Analysis
Synoptic dZ Accuracy Analysis Scanner to Scanner

Z Probe Vertical Accuracy Check
Generate LIDAR Stereo Pairs

GeoCue Corporation has been awarded US Patent 7,804,498 for “Visualization and storage algorithms associated with processing point cloud data.”

Directly collect geomorphic features from LIDAR intensity data

Direct Photogrammetric Workstation Integration

Export Stereo projects for remote exploitation

- or -

Exploit within the managed GeoCue Environment:

- Intergraph ISSD
- BAE Socet Set
- DAT/EM
Multiuser Data Access Control

Graphically Invoke Processing Tools
## Automatic Production History

<table>
<thead>
<tr>
<th>Status</th>
<th>User</th>
<th>Machine</th>
<th>Notes</th>
<th>System Messages</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
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<tbody>
<tr>
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<td>LEVI-PC</td>
<td>03/11/09 12:20 PM</td>
<td>Assigned macro: Ground</td>
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<td>03/11/09 12:20 PM</td>
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<td>JDE-PC</td>
<td>Assigned macro: Ground</td>
<td></td>
<td>03/11/09 12:20 PM</td>
<td>03/11/09 12:20 PM</td>
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<tr>
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<td>03/13/09 09:52 AM</td>
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## Automatic Management Statistics

<table>
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<th>Parameter</th>
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<tr>
<td>Planned User</td>
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<tr>
<td>Planned Start Date</td>
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<tr>
<td>Planned Completion Date</td>
<td>04/15/09</td>
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<tr>
<td>Budgeted Eff (Hours)</td>
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<td>Actual Start Date</td>
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<tr>
<td>Actual Completion Date</td>
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<tr>
<td>% Complete</td>
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<td>Estimate To Complete (Hours)</td>
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<td>Estimate At Completion (Hours)</td>
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<td>0.77</td>
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<tr>
<td>% Variance</td>
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Graphical Project Status

Integrated Distributed Processing

Dispatch - run a task on a remote machine
Distribute – spread a “splitable” task across multiple machines
Schedule – set a task to start at a delayed time
Assigning Macros in GeoCue

<table>
<thead>
<tr>
<th>Step</th>
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<tr>
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<tr>
<td>2</td>
<td>Set Population Parameters</td>
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<tr>
<td>3</td>
<td>Populate</td>
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<td>4</td>
<td>Solar QF</td>
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</tr>
<tr>
<td>5</td>
<td>Assign Macro</td>
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<td>6</td>
<td>Run Macro</td>
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<tr>
<td>7</td>
<td>Process in TerraScan</td>
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<td></td>
</tr>
<tr>
<td>8</td>
<td>Real QC</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Running Macros

- If run locally:
  - Will allow interactive viewing of either TerraSlave or Microstation with TerraScan
- If run through dispatch:
  - TerraSlave or Microstation with TerraScan will run in the background without showing either program
Macro Results

- Synoptic view of macro progress and errors
- Better access control as working segments remain locked until no longer needed as a neighbor for remaining processing blocks.
- Easy access to TerraSlave macro logs for review or quick error resolution.
Step Level Access Control

Workflow

- A Step can be defined by its predecessors, successors and error/warning states:
Workflow

1. Manage Catchpoint Files
2. View LAS in PointVue
3. View Population Parameters
4. View LAS in TerraScan
5. Set Design File

Post-Production Assessment

(Requires optional Project Administrator)
Multi-Project Web Status
(Requires GeoCue Federator)

Automated Processing
(Requires GeoCue Departmental Server)

- In the spirit of “Button Clicks cost money” in production scenarios Geoue 2011.1 added:
  - Automatic cloud selection and dispatch
  - Auto Run Next Step
  - Inter-Checklist Step Linking
QCoherent Tools for Product Generation and Data Dissemination

LP360 for ArcGIS

- Custom extension for ArcGIS
- Takes advantage of the binary LAS format
- Customized tools built specifically to leverage LIDAR data
  - Breakline generation
- Optimized cross-section/profile data viewer
- Embedded 3D Viewer
- Does not require 3D Analyst or Spatial Analyst
LP360 - LIDAR Export Wizard

- Export to either Point or Surface Type
- Point File
  - LAS
  - ASCII XYZ
  - To Shapefiles
  - To DXF/DGN
- Surface/Grid File
  - Raster Files
    - Binary (float) format
    - ASCII format
    - ESRI Binary Grid
  - Contours (Shapefiles, CAD files)
  - Surface Attributes:
    - Elevation
    - Slope
    - Aspect
    - Hillshade
  - Breakline enforcement

Data Dissemination

(Requires QCoherent LIDAR Server)
Summary

- GeoCue has introduced new techniques that have revolutionized LIDAR production (e.g. LIDARgrammetry)
- GeoCue users report >30% increased productivity
- GeoCue makes very large projects manageable
- GeoCue provides the tools necessary to dramatically improve product quality
- Significant new features are added on a 6 month release cycle
- LP360 for ArcGIS tools allow for easy product generation
- LIDAR Server allows for data dissemination