ArcGIS: A Platform for Point Cloud Processing

Larry Batten – Account Manager (BLM, USGS)
Your Mission is Our Mission
Support for Deepening Analytic Expertise

Calculating Tree Canopy
Finding Historic Features
Exploratory

Studying the Earth’s Shape

Geomorphologic Analysis
Point Clouds from LiDAR
Your Mission is Our Mission
Support for Management and Preparedness

- Forestry Analysis
- 3D Viewshed
- Threat Assessment
- Corridor Management
- Inundation Analysis
Your Mission is Our Mission
Support for Disaster Mitigation

Potential tsunami inundation: Bandon, Oregon

Data courtesy of DOGAMI
Laser Scanning is Opening a World of Applications

Point Clouds require a new generation of capabilities to maximize their use

Elevation:

Facilities:
- Asset Management
- Property Records
- Infrastructure

Environment:
- Hydrography
- Biomass

3D Features:
- Urban Planning
- Transportation
- Utilities

Point Clouds are a transformation
## Enhanced Elevation Data Has Direct Cost Benefits

**Conservative Estimate of total annual cost benefit of $1.2 Billion**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Functional Area</th>
<th>Benefit</th>
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<tbody>
<tr>
<td>1</td>
<td>Flood Risk Management</td>
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<tr>
<td>2</td>
<td>Infrastructure and Construction Management</td>
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<td>3</td>
<td>Natural Resources Conservation</td>
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<td>Forest Resources Management</td>
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<td>River and Stream Resource Management</td>
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<td>10</td>
<td>Aviation Navigation and Safety</td>
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Source: USGS & Dewberry (2012), ‘National Enhanced Elevation Assessment’

USGS: 3D Elevation Program (3DEP)

Total Potential Benefit of over $13 billion/year
Encompassing Multiple Collection Strategies

Integrated data management is as fundamental as analysis tools

- Wide variety of collection parameters
- Over, on, and under – 360 Degree Field of View
- High resolution, high density data collection
- Combined with other sensors, especially imagery

A versatile, economical, and accurate remote sensing resource
ArcGIS Supports Multiple Implementation Patterns

Leveraging Common Computing Architecture

File Based

Database Centric

Server Centric

Web Centric

Point Cloud processing has been enabled throughout this evolution
ArcGIS Provides a Platform
A comprehensive environment for point cloud solutions

Enabling:
- Content Management
- Access
- Sharing
- Collaboration
- Apps

Desktop
Web
Device

Professional GIS
Portal

Server

Maps
Data
Apps
Services
Models
Workflows

Analytics:
- Elevation
- Viewshed
- Profile
- Extraction
- Classification

Extends point cloud applications to any device at any location
The Advantage of ArcGIS

Enabling technologies maximize Point Cloud processing

Content Management
- Shared Data Model
- Data Discovery
- Rapid Access
- Services

Analytics
- Integration with GIS
- Dynamic Processing
- Workflow Manager
- Partner Technology

Sharing & Collaboration
- Web & Cloud
- Maps & Apps
- User Mashups

Interconnected capabilities
An End-to-End Workflow for Point Clouds
Tightly integrated functional segments facilitate multiple processing chains

Laser scanned data easily flows from sensor to web services

Acquisition & Data Preparation

Data Management

Analysis

Collaboration & Sharing

Professionals Create and share Analysis

Users access data and conduct Visualization

Consumers access “dynamically” produced content

Laser scanned data easily flows from sensor to web services
Visualization & Analytics

Four categories of analysis tools result in thousands of derived products

- **Elevation Extraction**
  - Terrain
  - Bathymetry
  - Bare Earth

- **Classification**
  - Natural
  - Man-Made

- **3D Object Extraction**

- **Advanced Mensuration**
  - Area
  - Volume
  - Heights

- **Visualize**
  - 3D
  - Profile
Extending Beyond the Enterprise

Proven Architectures Support Inter-Agency Implementations
Cross Cutting Technical Capabilities

Data Prep, Management, and Sharing remain consistent while Analysis varies based on solution requirements

<table>
<thead>
<tr>
<th></th>
<th>Topography</th>
<th>Hydrography</th>
<th>Facilities</th>
<th>Forestry</th>
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<tr>
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From Sensor to Web Services
Elevation to Support Hydrography

- Acquisition & Data Prep
- Data Management
- Analysis & Visualization
  - Elevation
  - Mensuration
  - Classification
  - 3D Extraction
- Sharing & Collaboration
## Acquisition & Data Preparation

### Step 1

**Acquisition & Data Prep**

- Data Management

**Analysis & Visualization**

- Elevation
- Mensuration
- Classification
- 3D Extraction

**Sharing & Collaboration**
Data Management

- Acquisition & Data Prep
- Data Management
- Analysis & Visualization
  - Elevation
  - Mensuration
  - Classification
  - 3D Extraction
- Sharing & Collaboration
Analysis & Visualization

- Acquisition & Data Prep
- Data Management
- Analysis & Visualization
  - Elevation
  - Mensuration
  - Classification
  - 3D Extraction
- Sharing & Collaboration
Sharing & Collaboration

Step 4

Acquisition & Data Prep

Data Management

Analysis & Visualization
- Elevation
- Mensuration
- Classification
- 3D Extraction

Sharing & Collaboration
Reaching Beyond Elevation

A Hero’s Journey to explore the rich variety of Laser Scanning Applications

- Forestry
- Coastal Change
- Utility Corridors
- Bio Mass
- Surface Mining
- Facilities
- Transportation
- Property Records
- Asset Management
- Disaster Recovery
Forestry

Acquisition & Data Prep

Data Management

Analysis & Visualization
- Elevation
- Mensuration
- Classification
- 3D Extraction

Sharing & Collaboration
Facilities

- Acquisition & Data Prep
- Data Management
- Analysis & Visualization
  - Elevation
  - Mensuration
  - Classification
  - 3D Extraction
- Sharing & Collaboration
Transportation

Acquisition & Data Prep

Data Management

Analysis & Visualization
- Elevation
- Mensuration
- Classification
- 3D Extraction

Sharing & Collaboration
Summary: ArcGIS Is An End-to-End Solution for Point Clouds

Tightly integrated functional segments facilitate multiple processing chains

1. Create an authoritative source of elevation for shared analysis and visualization
2. Manage, analysis and share to maximize the value
3. Foster collaboration