Lidar and ArcGIS Pro: What’s New?

Lindsay Weitz
Geoff Taylor
Outline

- Lidar background
- ArcGIS Pro tools
- I3S
- Apps
  - 3D Web Scenes
  - ArcGIS API for JavaScript
- Drone2Map
ARCGIS IS A LiDAR PLATFORM
Empowering you to make informed decisions from remotely sensed data
ARCGIS SUPPORTS MANY FLAVORS OF LiDAR

Airborne | Terrestrial | Mobile | Drone/UAV
Application Fusion: ArcGIS Pro

ArcMap

ArcCatalog

ArcGlobe / ArcScene
ArcGIS Pro: Tools
Data Structures for lidar support in ArcGIS Pro

- File01.las
- File02.las
- ...
- File99.las

Multiple files/folders

- Analyze and update
  - LAS dataset

- Manage, serve, share
  - Mosaic dataset / point cloud scene layer
Lidar data storage – zLAS

- Introduced January 2014
- Compression, sorting, and indexing
- Direct read
  - Parallel decompression added to ArcGIS apps in 10.3
- Features & Benefits
  - Re-sequence points w/ geospatial index
  - Optimized for random access
  - Lossless compression
  - Transparent integration with LAS dataset
- Compresses .las to .zlas
- Decompressed .zlas to .las

<table>
<thead>
<tr>
<th>Points</th>
<th>.las size (mb)</th>
<th>.zlas size (mb)</th>
<th>% Size Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 million</td>
<td>31.5</td>
<td>5.7</td>
<td>~82%</td>
</tr>
</tbody>
</table>

Additional Notes:
- .zlas files cannot be edited (Must Decompress to Classify)
- .zlas files can be used in all Analysis Tools that support .las

Stand-Alone .exe file
- Download from ArcGIS.com
LiDAR in ArcGISPro
Interacting with LiDAR Datasets
LAS Dataset Properties

LAS Dataset Properties: LAS Dataset.lasd

General

Summary:
- Name: LAS Dataset
- LAS Files: 16 (16 LAS files, 0 zLAS files)
- SurfaceConstraints: 0
- LAS Points: 157,486,819
- Data Size: 4,205.37 MB
- Uncompressed Size: 4,205.37 MB

Extent:
- Store relative path names to data sources

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>627,500,001</td>
<td>629,000</td>
</tr>
<tr>
<td>Y</td>
<td>103,500</td>
<td>105,499,999</td>
</tr>
<tr>
<td>Z</td>
<td>-2,828,1</td>
<td>3,550.59</td>
</tr>
</tbody>
</table>

XY Linear Unit: Foot_US
Z Unit: Foot_US

View Metadata
Add To Current Map
Add To New Map
Add To New Scene
Properties
Lidar tools in ArcGIS Pro

- Classification Code
  - No Change
  - Model Key
  - Withheld
  - Synthetic
- Apply Changes
- LAS Dataset
  - Change LAS Class Codes
  - Classify LAS Building
  - Classify LAS By Height
  - Classify LAS Ground
  - Classify LAS Noise
  - Classify LAS Overlap
  - Extract LAS
  - LAS Point Statistics By Area
  - Locate LAS Points By Proximity
  - Set LAS Class Codes Using Features
  - Title LAS
- Terrain Dataset
- TIN
Polygon Volume

- Enhance existing geoprocessing tool to support LAS dataset as input surface. Current support limited to TINs and Terrains.
- Use of drones to collect photogrammetric point clouds to measure volumes for things like stockpiles is increasing rapidly.
- LAS dataset is a natural fit for this data so direct support in this tool improves productivity and usability.
Classify LAS Noise

- New GP tool to classify noise points in lidar.
- Erroneous points are caused by a variety of things such as haze, birds, and water.
- Present at least to some degree in all lidar collections.
- Noise interferes with display and processing of the data.
- This is a fundamental capability.
Classify LAS Overlap

- New GP tool to assign the overlap flag/code to points in areas of overlap between flight lines.
- Area of overlap introduces high frequency noise to ground which interferes with creation of high quality DEMs. It’s therefore desirable to exclude the overlap.
- Tool is needed to help improve quality of DEMs ArcGIS can produce,
LiDAR Classification
Classifying LiDAR in ArcGIS Pro
LAS Point Statistics By Area
Classify LAS by Height

**Input LAS Dataset**

Define height breaks and associated classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

- Use just model key points for ground (optional)

**Profile View**

1. Reclass points below ground to noise (optional)
2. Reclass points above max height to noise (optional)
3. Classify within processing extent only (optional)
4. Calculate statistics (optional)
Locate LAS Points By Proximity

Data courtesy of PhotoScience
Locate LAS Points By Proximity
Enhance existing GP tool to perform VCS transform.
This is a natural extension to the tool’s projection support and is an important function to enable for this 3D data type.
Lidar/3D Sample Tools

- Available in ArcGIS 10.2 – 10.5
- Sample geoprocessing tools
  - [http://links.esri.com/3dSamples](http://links.esri.com/3dSamples)
Best Practices

- Tiled LAS, v1.1 or higher
- Projected, rearranged, indexed
  - zLAS
- File size: 1 – 2 GB or less (<500 MB if not rearranged)
- Keep file I/O local, avoid network
- Study area boundary included as constraint
- Airborne lidar
  - Classified (bare earth, non-ground)
  - Breaklines for hydro enforcement
- Terrestrial lidar
  - RGB & intensity values, classified

* Also applies to photogrammetric point clouds*
Rearranging Point Records

Spatial distribution of points

Physical location in file
I3S: Scene Layer Packages

3D Web Scenes
ArcGIS Online

Your LiDAR Hosted & Streamed from the Cloud
Indexed 3d Scene Layer (I3S)

- **Specification:**
  - [https://github.com/Esri/i3s-spec](https://github.com/Esri/i3s-spec)
  - Point cloud scene layer – lidar data
  - Integrated Meshes – surface model
  - 3D objects – 3D models
  - Point features - schools, hospitals, signs
Local Government Scenes

Overview

The Local Government Scenes is a set of ArcGIS Pro projects that can be used to author high-quality 3D scenes for your local government. These scenes are organized in different Levels of Detail (LOD) and derived from 2D operational data managed by a department or agency within a local government. Once authored, the 3D scenes are a foundation for 3D workflows and applications; and provide a consistent geographic context across local government departments and agencies.

Requirements

You may be interested in

ArcGIS for Local Government includes several related maps and apps that also can be configured in your organization:

- Review Proposed Developments
- Local Government Basemaps
- Local Government Information Model
Modeling a City Without Esri Tech

If 1 building takes 15 minutes to model.
Number of Staff required to model the City in 1 year

**Redlands**: 26,000 buildings
- 3 Person Team
- 6,400 Hours

**Orlando**: 110,000 buildings
- 14 Person Team
- 27,500 Hours

**Chicago**: 1,200,000 buildings
- 150 Person Team
- 300,000 Hours
<table>
<thead>
<tr>
<th>Level of Detail</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition:</strong></td>
<td>3D Extrusion</td>
<td>3D Extrusion with Roof Form or Building Shell</td>
<td>High Detail 3D Building Models</td>
<td>Interior Spaces and Floors</td>
</tr>
<tr>
<td><strong>Data Required:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Footprints</td>
<td># of Stories or Total Height &amp; or Usage</td>
<td># of Stories or Total Height or Usage &amp; if available Roof Height</td>
<td>3D Building Shell with Fine details (Textured or Untextured)</td>
<td>3D Building Shell Interior Spaces (CAD or BIM)</td>
</tr>
<tr>
<td>Streets</td>
<td>Street Centerlines</td>
<td>Street Centerlines with Width attributed</td>
<td>Detailed Streets (CAD)</td>
<td>Street Furniture, Stop Lights, Signage, Infrastructure lines (GIS/CAD)</td>
</tr>
</tbody>
</table>

**3D City Levels of Detail**

Different levels of detail for Smart 3D City Models
3D Web Scenes
Meshing together 2D + 3D Content
ArcGIS API for JavaScript 4.3
ArcGIS API for JavaScript 4.3

Develop custom web apps leveraging your lidar and derivatives!

Drone2Map Version 1.2

Faster, more efficient processing
- Process multiple project areas in batch mode
- Create products without running processing over
Drone2Map Version 1.2

Improved output quality
- Multi-LoDs for better quality 3D meshes
- Faster performance in Web Scenes
- Improved default settings for 3D meshes
Drone2Map Version 1.2

Improved usability
- Launch ArcGIS Pro with D2M project (for desktop analysis)
- Product markup and web map sharing
Please Take Our Survey on the Esri Events App!

Download the Esri Events app and find your event

Select the session you attended

Scroll down to find the survey

Complete Answers and Select “Submit”