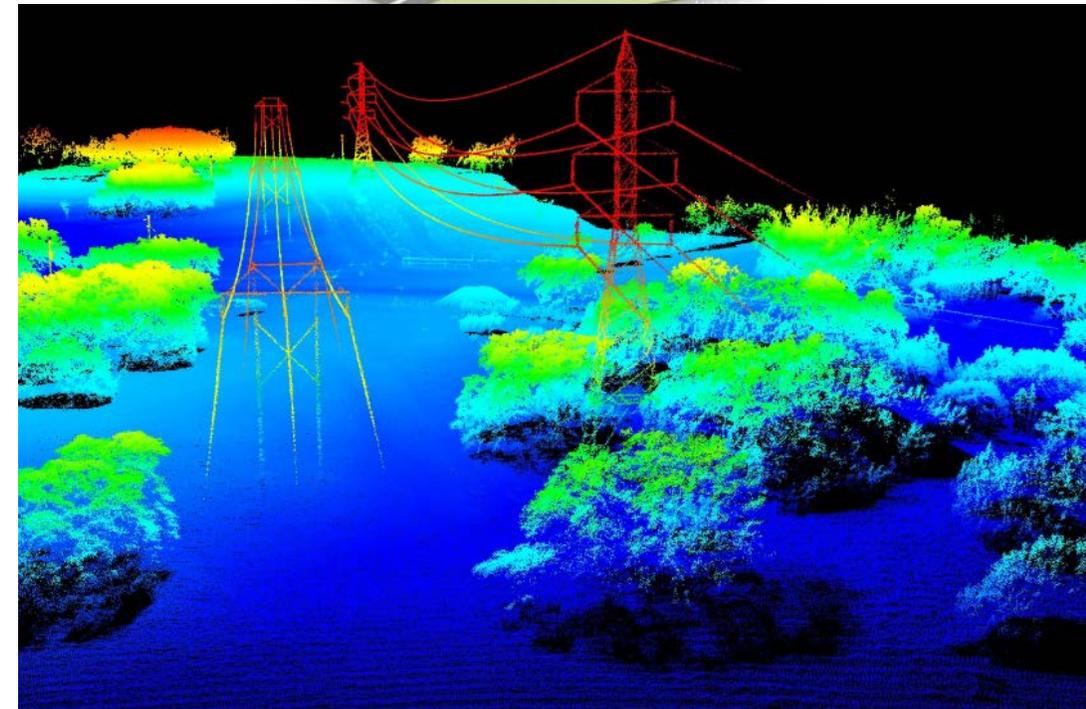
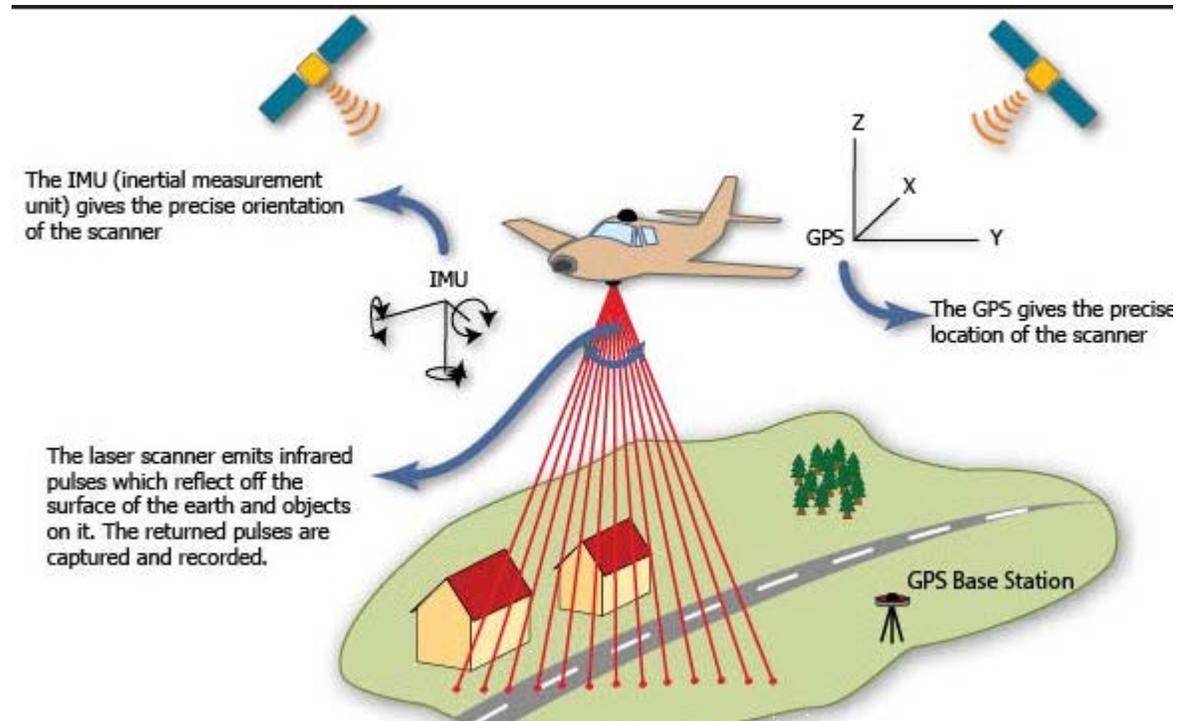


LiDAR

Light Detection and Ranging

LiDAR – What is it

- Light Detection and Ranging
- Active Remote sensing technology
 - Unlike Photogrammetry
- How is it collected?
 - Helicopter, Airplane, UAS
 - Terrestrial (ground based laser scanners)



How does it work?

- Airborne LiDAR system

- Laser pulses sent out >400k pulses per second
- Speed of light. Time is recorded, converted to distance
- GNSS system, computer, IMU correction, angle tilt
- GNSS survey-grade ground control points for further correction
- Computer interprets all this to create the file

- Terrestrial Scanners

- Tripod or mounted on car
- Speed of light
- GPS to geolocated point cloud
- No IMU needed



LiDAR returns

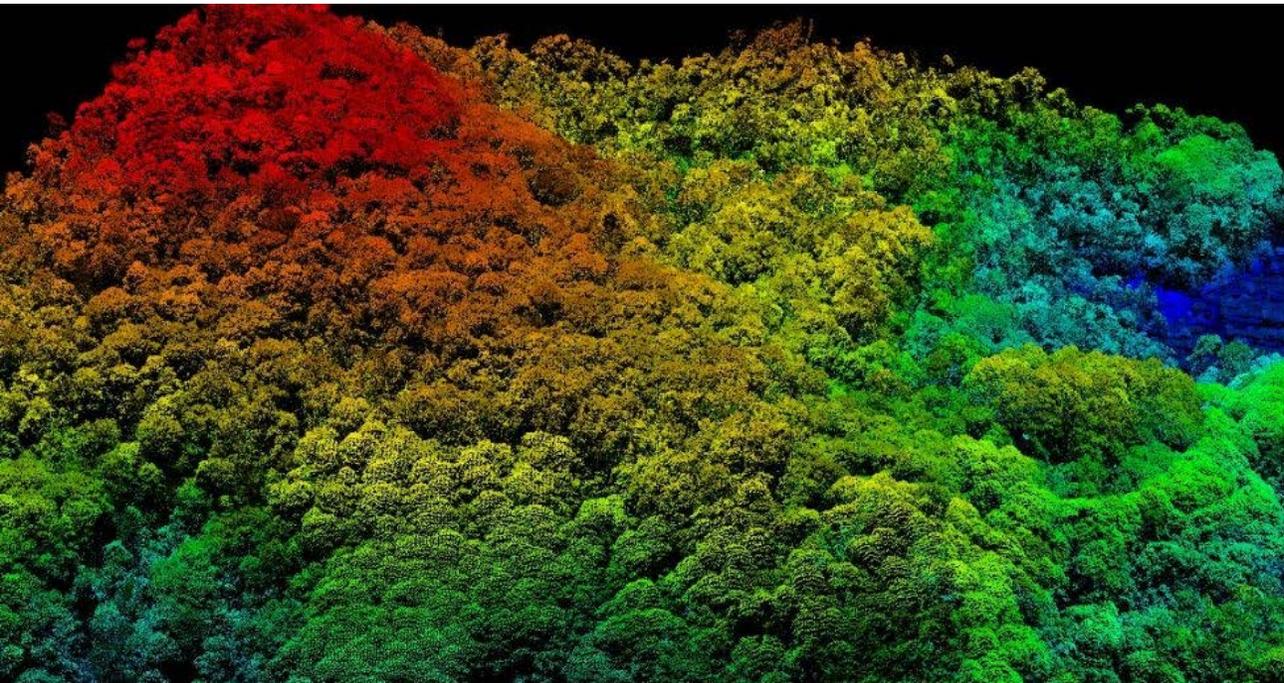
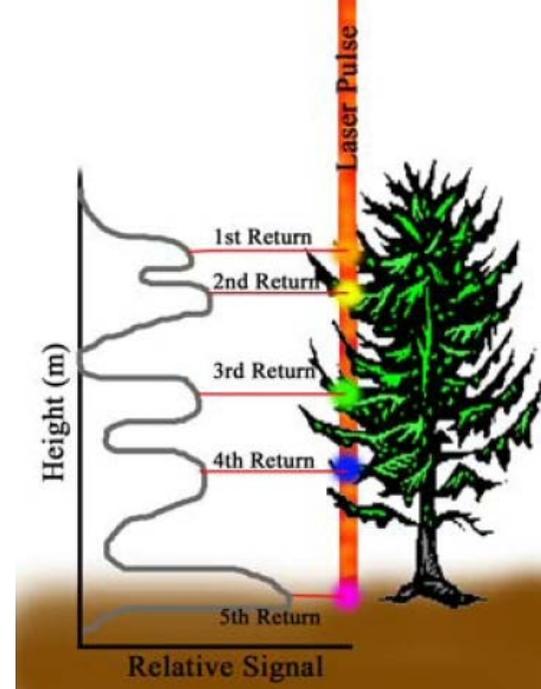
- Classifications
 - Ground, Noise, Water, Vegetation (high, med, low), railroad, road, bridge, or Unclassified
 - ASPRS codes for complete list
- Location (XYZ)
- Scan Angle
- Intensity
- Return Number and Number of Returns (i.e 1 of 4, 1of1)
- GPS Time

Table 4.9 - ASPRS Standard LIDAR Point Classes

Classification Value	Meaning
0	Created, never classified
1	Unclassified ¹
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point ("low noise")
8	High Point (typically "high noise"). Note that this value was previously used for Model Key Points. Bit 1 of the Classification Flag must now be used to indicate Model Key Points. This allows the model key point class to be preserved.
9	Water
10	Rail
11	Road Surface
12	Bridge Deck
13	Wire - Guard
14	Wire - Conductor (Phase)
15	Transmission Tower
16	Wire-structure Connector (e.g. Insulator)
17	Reserved
18-63	Reserved
64-255	User definable - The specific use of these classes should be encoded in the Classification lookup VLR.

Vegetation

- Multiple returns for vegetation
 - It's not X-raying the leaves – just getting many returns.
- Leaves and branches in the canopy
- Extremely valuable tool for studying canopy heights, shape, density of leaves, understory, forest structure

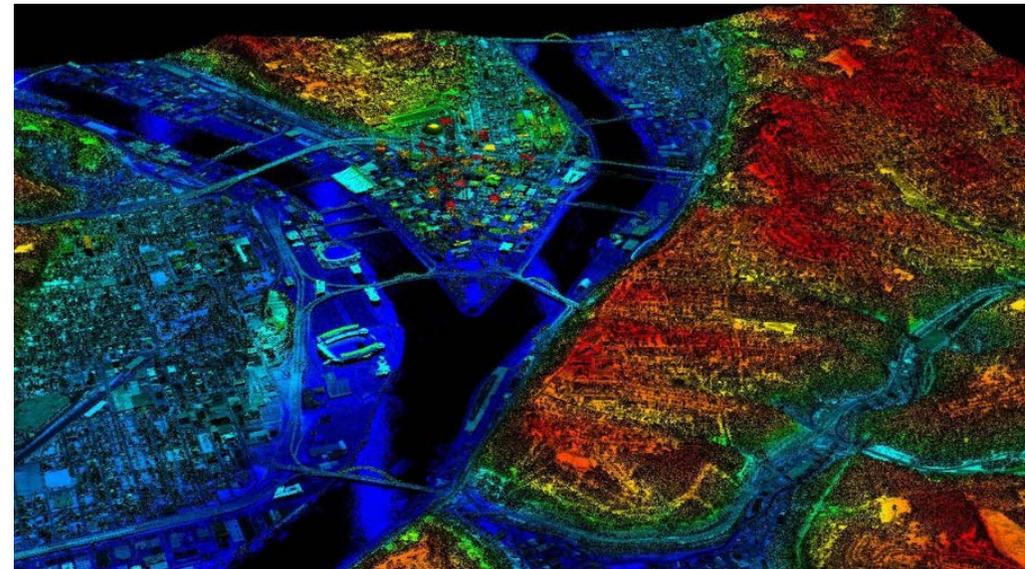


LiDAR Sources

- USGS National Map
 - National LiDAR dataset
 - Global Mapper links directly to this via “online sources” toolbar button
- USGS Earth Explorer
- Open Topography
- NRCS Geospatial Data Gateway (order by state/county)
 - <https://gdg.sc.egov.usda.gov/>
- NOAA Interagency Elev. Inventory.
 - <https://coast.noaa.gov/intentory/>
 - Great place to learn what’s available from other sources
 - Isolate topographic LiDAR and click on location
- State Repositories
 - Alabama GEOHUB -- Or other sources?

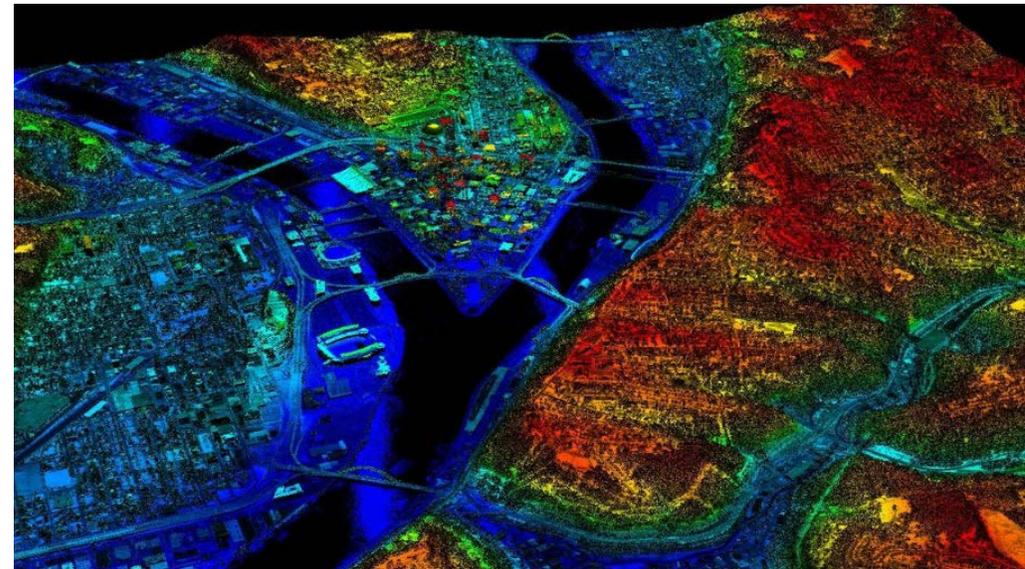
How do we view it?

- Giant point clouds LAS or LAZ format
 - Millions or even Billions of points
- ArcGIS extension
- Autodesk ReCAP
- **Global Mapper (Best tool)**
 - **GM LiDAR module**
- CAD will crash
 - Suggest thin the LiDAR cloud first, or create contours in GM first for CAD export



What do we do with it?

- Build surface models
 - DEMs, DTMs, Contour Maps, cross sections
- Foresters
 - Canopy height, forest structure/shape
- Riparian analysis
 - Stream orders, identify tributaries, watershed, riparian vegetation
 - Some LiDAR can penetrate shallow water
- Other
 - Archaeology, self driving cars



Sources

- <https://www.bluemarblegeo.com/products/global-mapper.php>
- <https://gisgeography.com/lidar-light-detection-and-ranging/>
- <http://geoawesomeness.com/drone-lidar-or-photogrammetry-everything-your-need-to-know/>
- <https://www.elprocus.com/lidar-light-detection-and-ranging-working-application/>
- www.faro.com
- www.leicageosystems.com