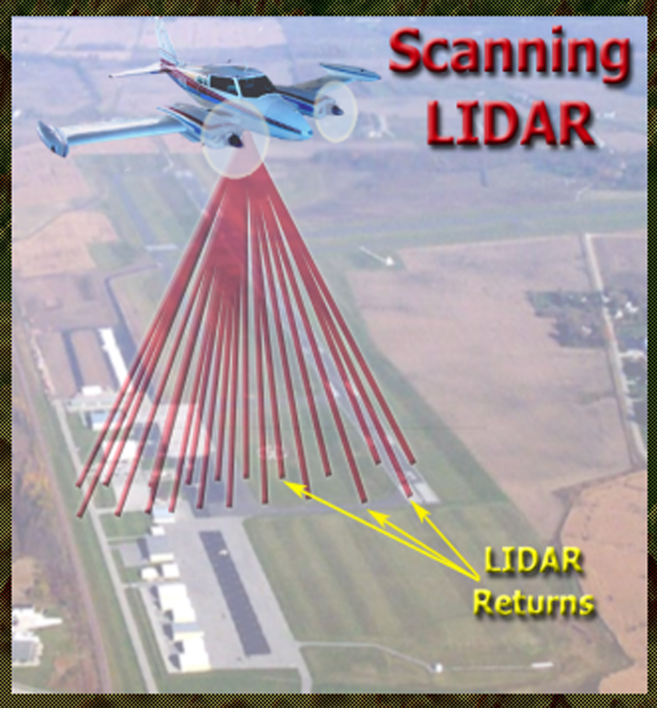
Innovative Approaches to Analysis of Lidar Data for *The National Map*

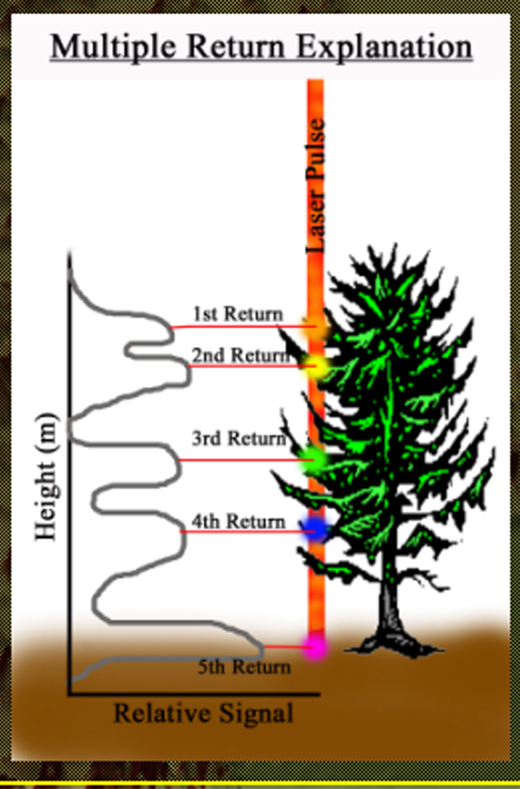
Jason M. Stoker
Senior Lidar Remote Sensing Scientist, USGS/SAIC

What is LIDAR?

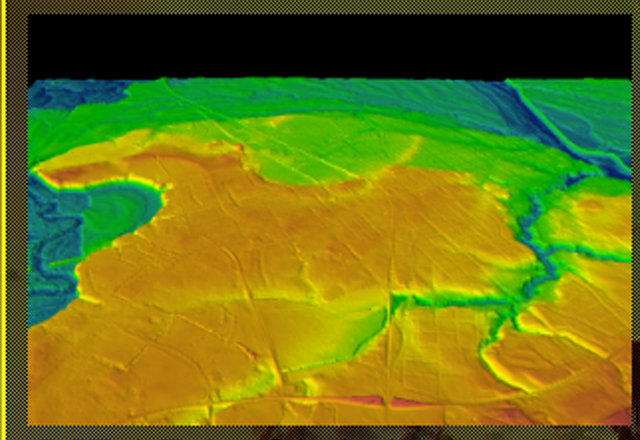


LIDAR stands for Light Detection and Ranging. A laser is fired at the ground up to 50,000 times a second, where the laser beam hits something, bounces back and the X,Y,Z location of where the laser hit is recorded. It allows us to record point locations at very high resolutions (1-meter).

A multiple-return LIDAR system records multiple reflections for each laser pulse. This allows us to penetrate vegetation in order to record the X,Y,Z location of the underlying ground, or whatever is under the trees. It also allows us to estimate vertical components of the forest (e.g., tree height).

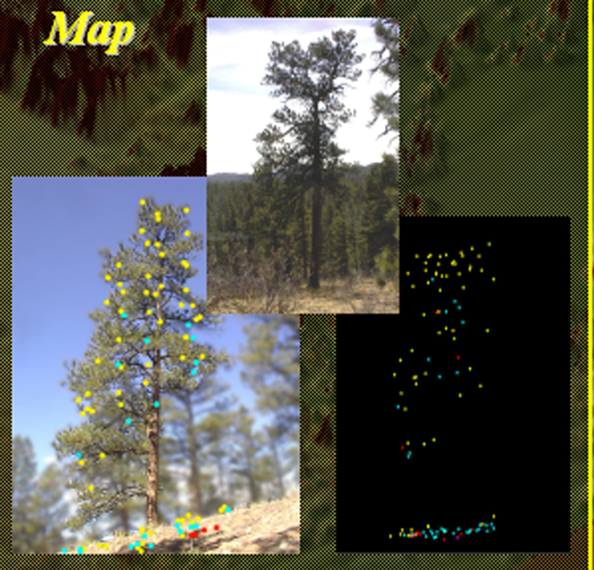


What is LIDAR used for?



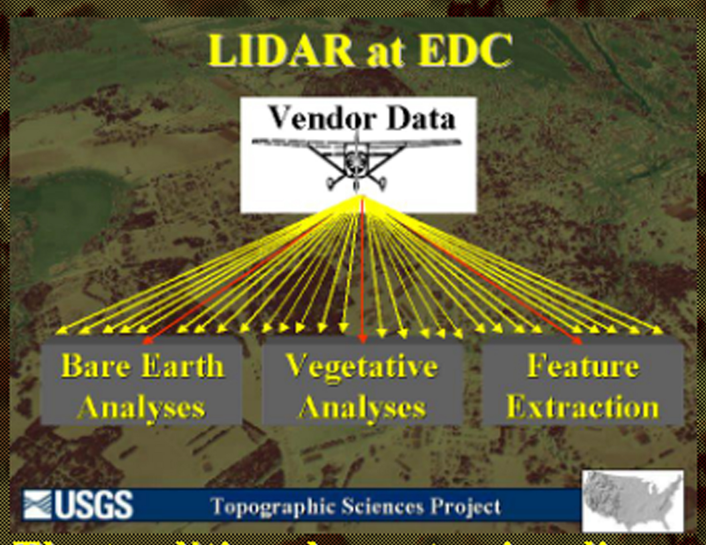
The primary use of LIDAR is for creation of high-resolution bare earth models. These models are used in high-resolution elevation layers of *The National Map*

LIDAR is also being used in forestry and ecological applications because it can give vertical information not possible using traditional optical sensors. This vertical information is important in fire behavior modeling, biomass estimation, and improved land cover classifications.



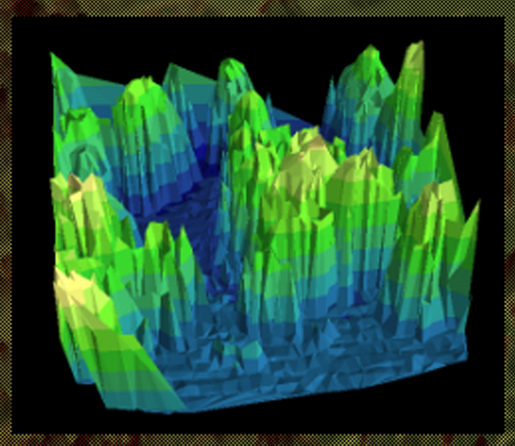
LIDAR is also being proven as an effective tool for extracting and visualizing man-made features such as buildings, because of its high resolution and vertical component.

LIDAR research at EROS

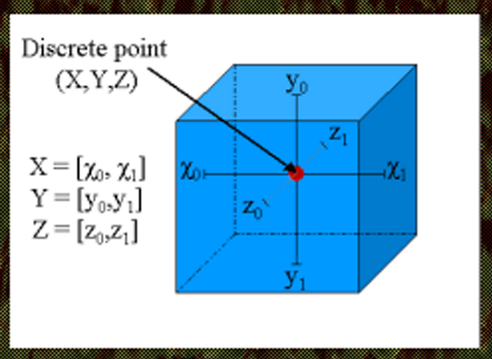


The traditional way to visualize LIDAR data is to convert the X,Y,Z points into a surface. The problem with representing vegetation and man-made features as a surface is that you cannot tell what is underneath that surface. This defeats the purpose of multiple-return LIDAR.

We are using LIDAR in research for bare earth, vegetation and feature extraction for inputs into *The National Map*. We are also developing a new way to visualize and quantify the information contained in the LIDAR data .



A clump of trees represented as a surface



Voxel

We are researching the use of volumetric pixels, or voxels, to visualize and quantify bare earth, vegetation, and man-made features from LIDAR data

Voxel visualization of Lincoln, NE

Questions? Email Jason Stoker, jstoker@usgs.gov