



Jet Propulsion Laboratory  
California Institute of Technology



# Airborne Snow Observatory Equipment and Sensor Overview



Frank Gehrke, Bruce McGurk, Thomas Painter & ASO Team -  
Coop Snow Workshop, 4 Nov. 2015

To understand snowmelt magnitude and timing, we need to know -

**Snow  
Water  
Equivalent**

**Albedo**

# Twin Otter – 2013 and 2014



# Dan, Twin Otter, LiDAR, Spectrometer



# Twin Otter, Tuol. Meadow, 3/23/14



# King Air, 2015-2016



# Console Install, 2015

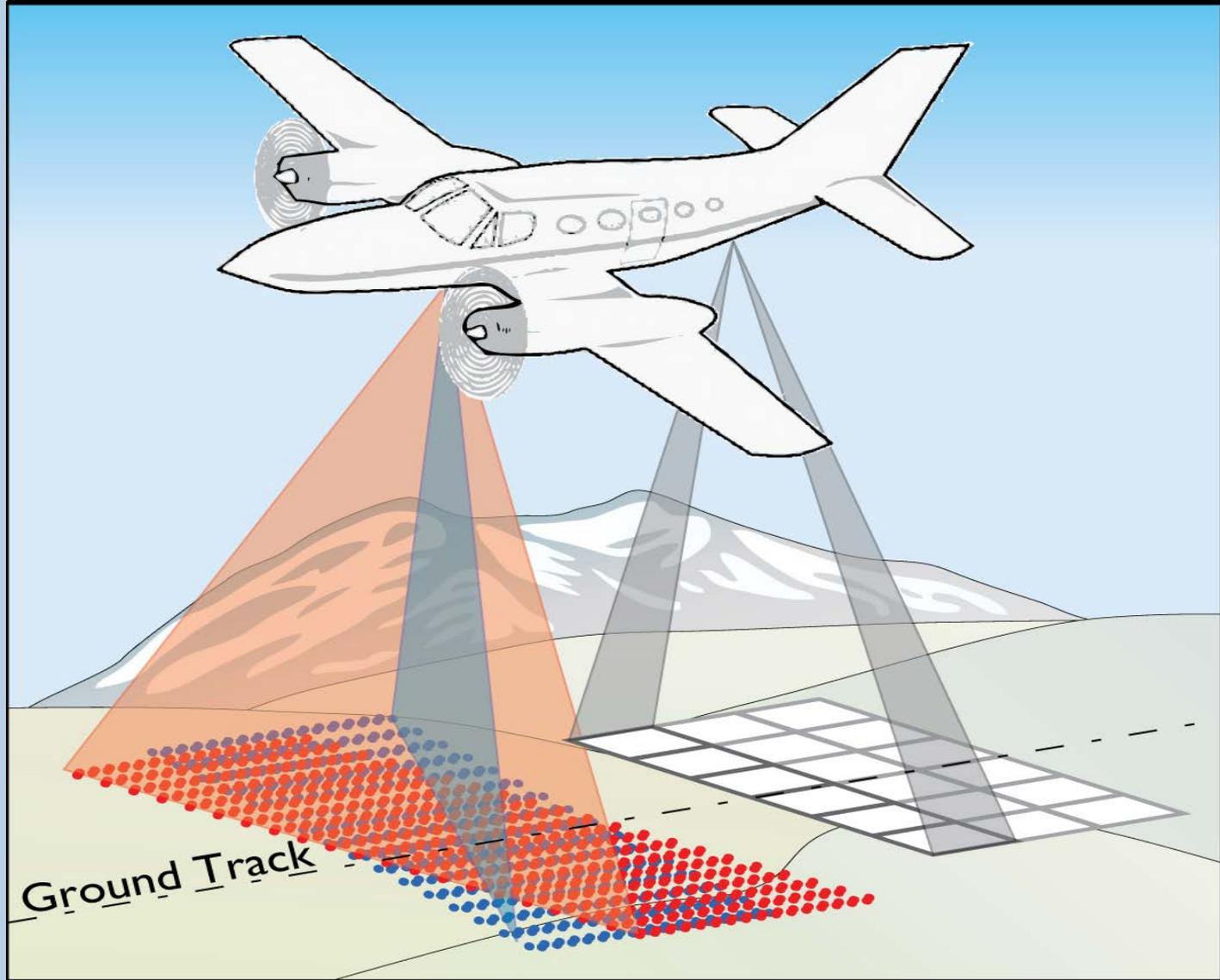


# King Air interior, 2014



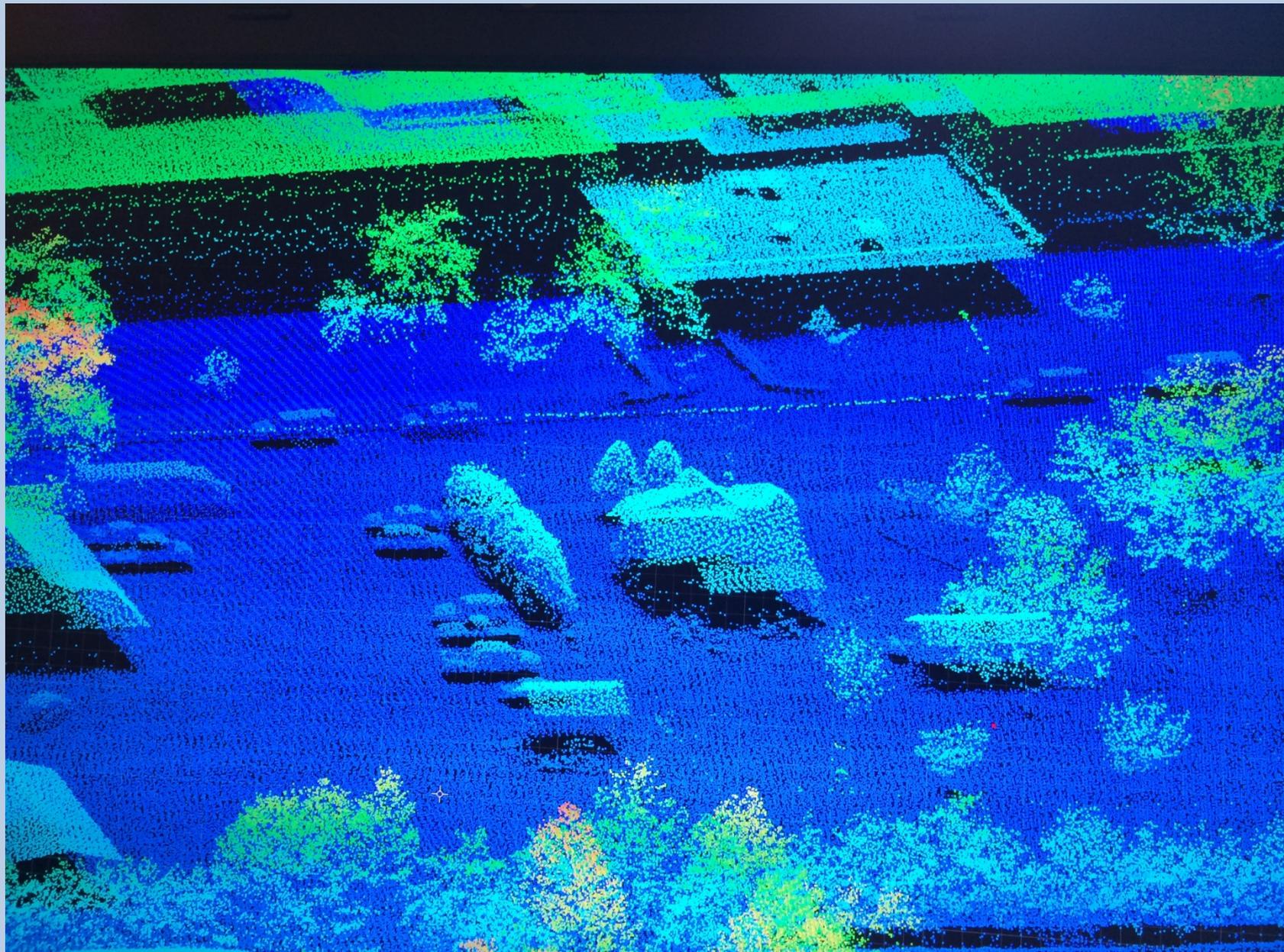
# LiDAR Dual-Beam, Viewing Port



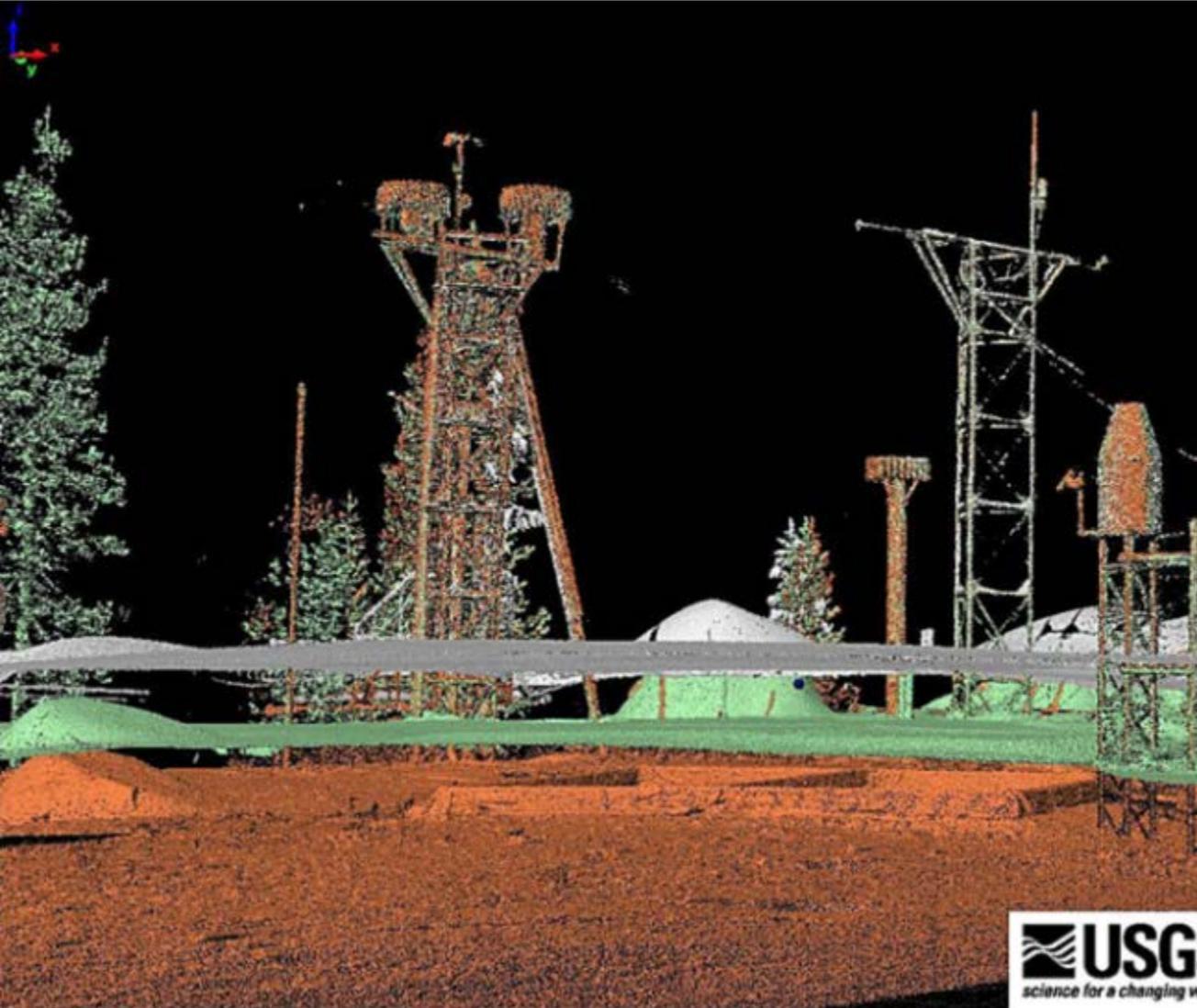


ASO scan configuration: Riegl Q1560 scanning LiDAR, Itres CASI-1500 imaging spectrometer

# LiDAR Point Cloud – Parking Lot



# LiDAR & Snow Depth – Jan 3 & 7, 2008



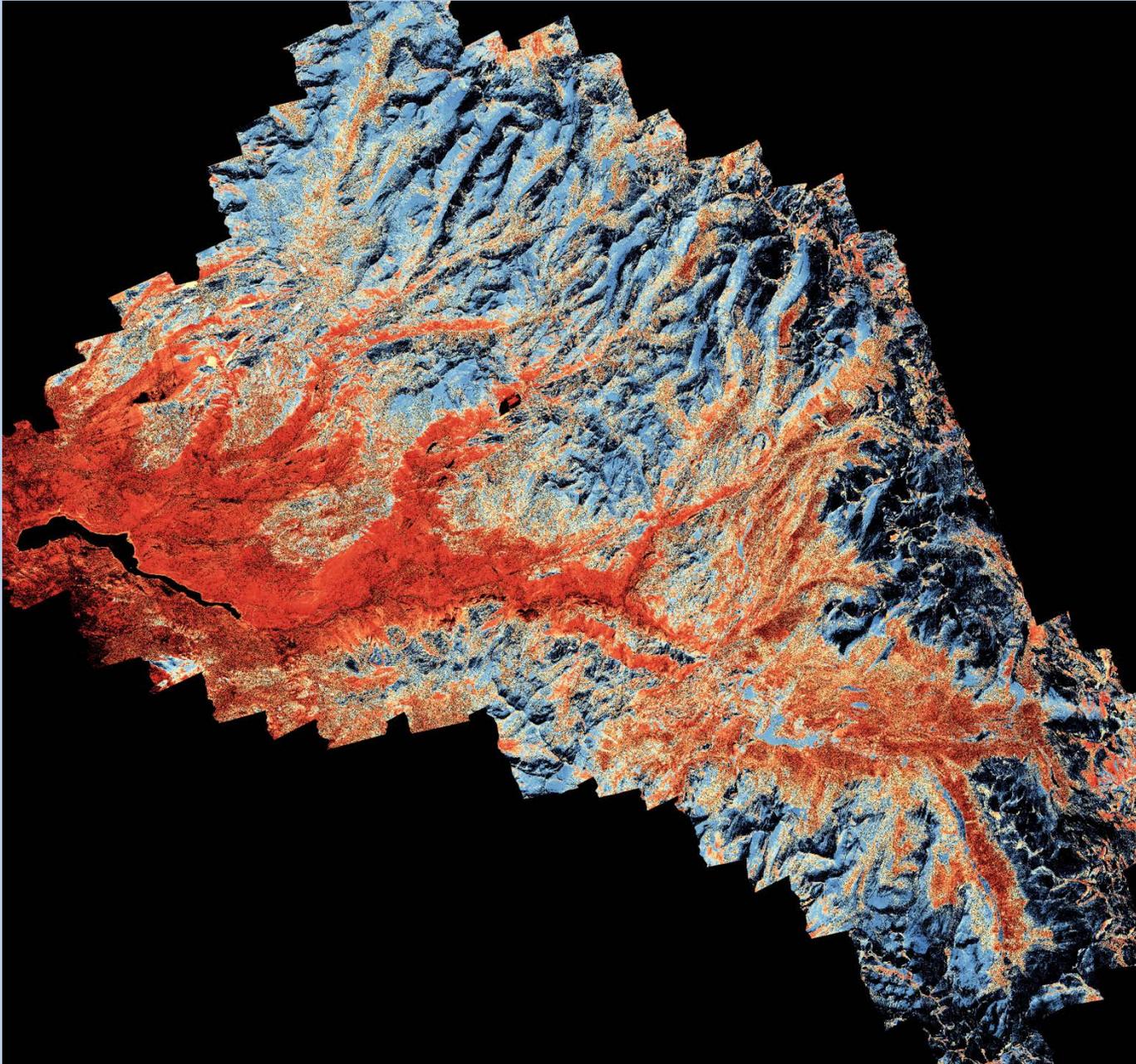
# Terrestrial LiDAR



# LiDAR Image



# Raw Albedo, Tuol., 3/23/2014

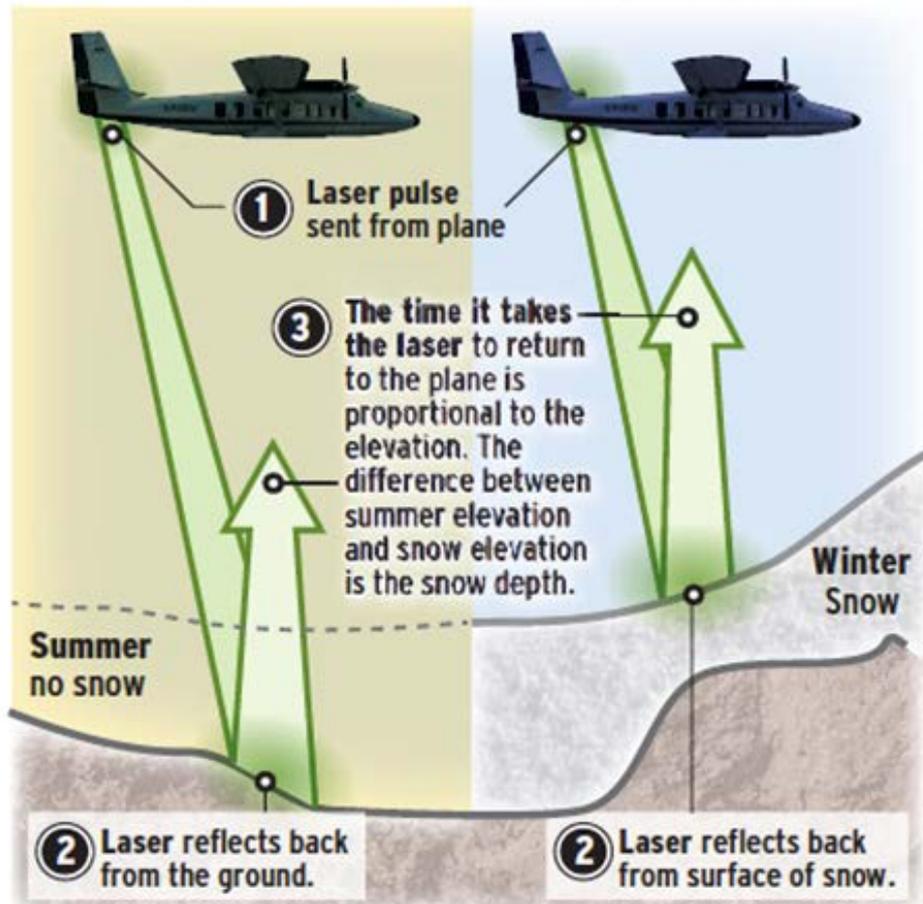




# Depth and Albedo

## How much snow?

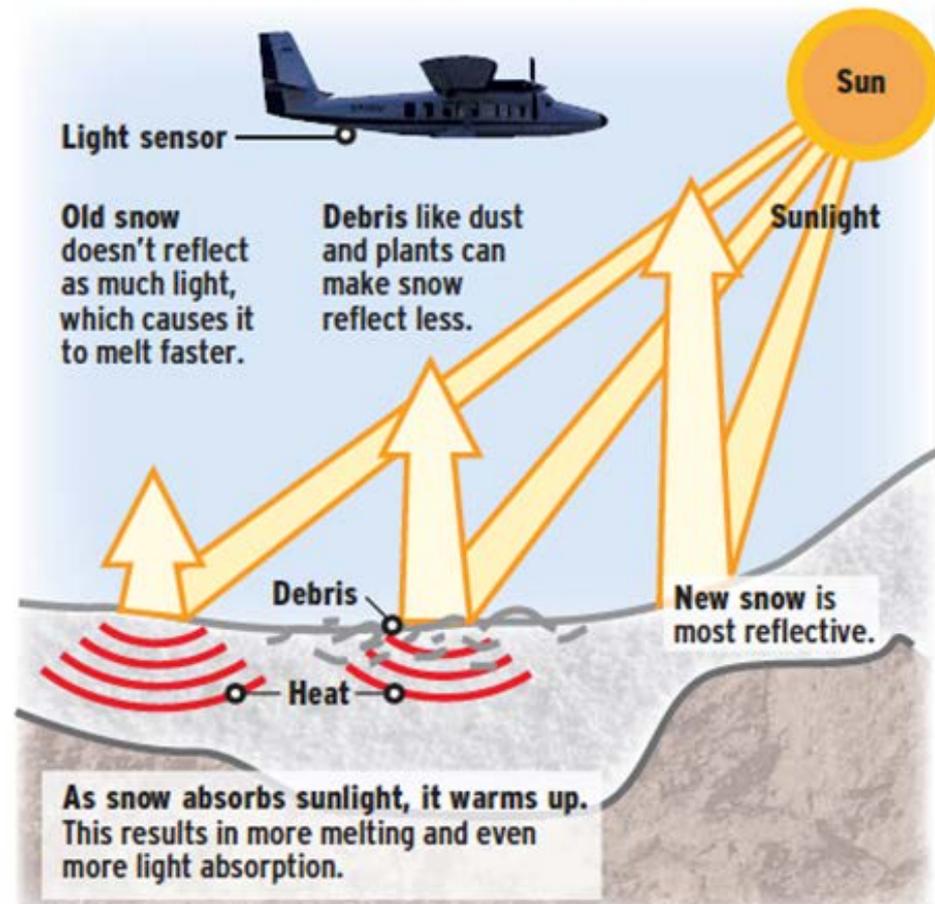
Using laser radar, known as Lidar, researchers measure the depth of snowpack in California.



Sources: Thomas Painter, Frank Gehrke, Optech Inc.

## How will it melt?

With an advanced light sensor, scientists measure snow's reflectivity – an indicator of how it will melt.



Maxwell Henderson / The Register

# ASO Footprint, Tuolumne Basin

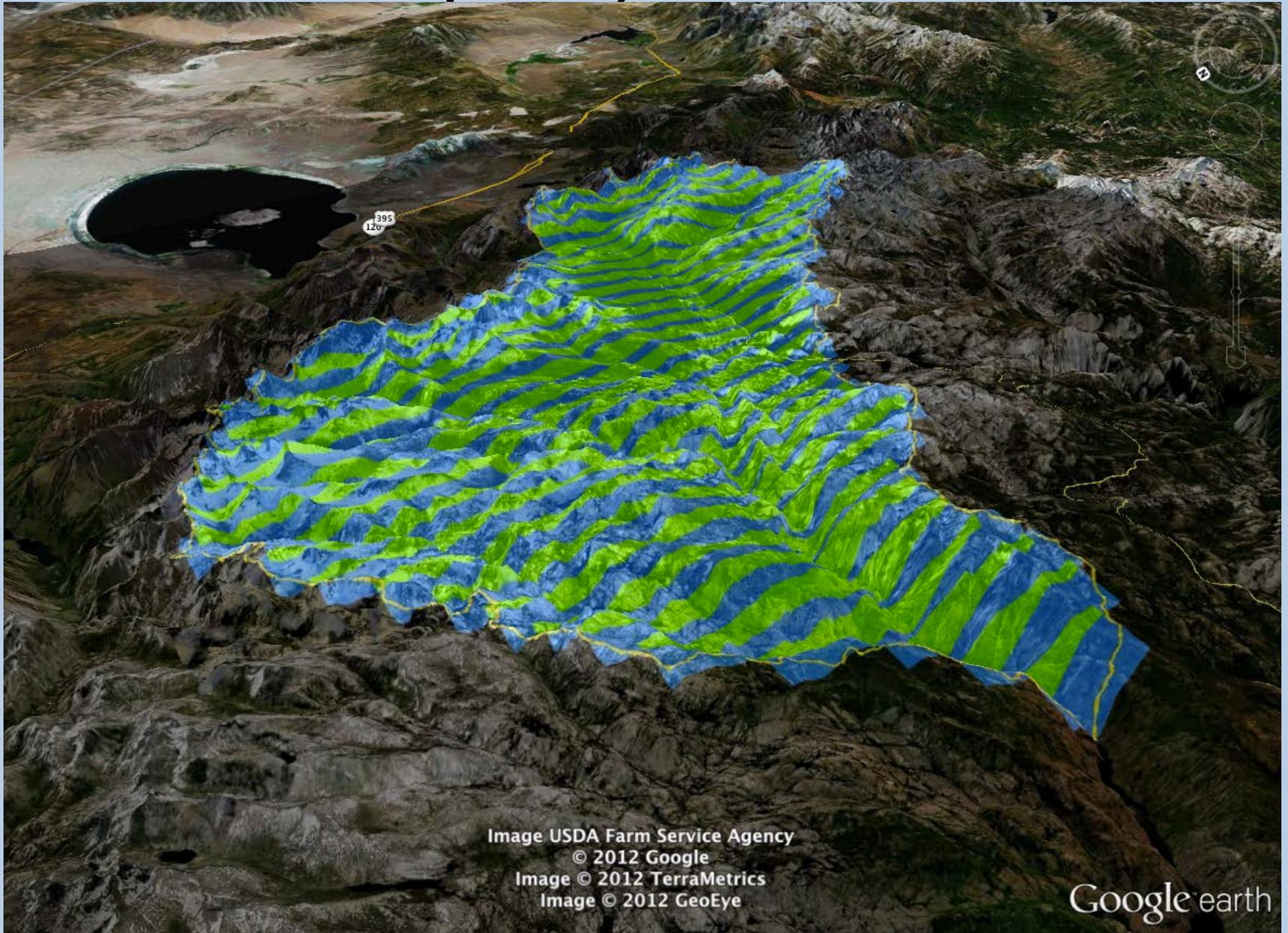
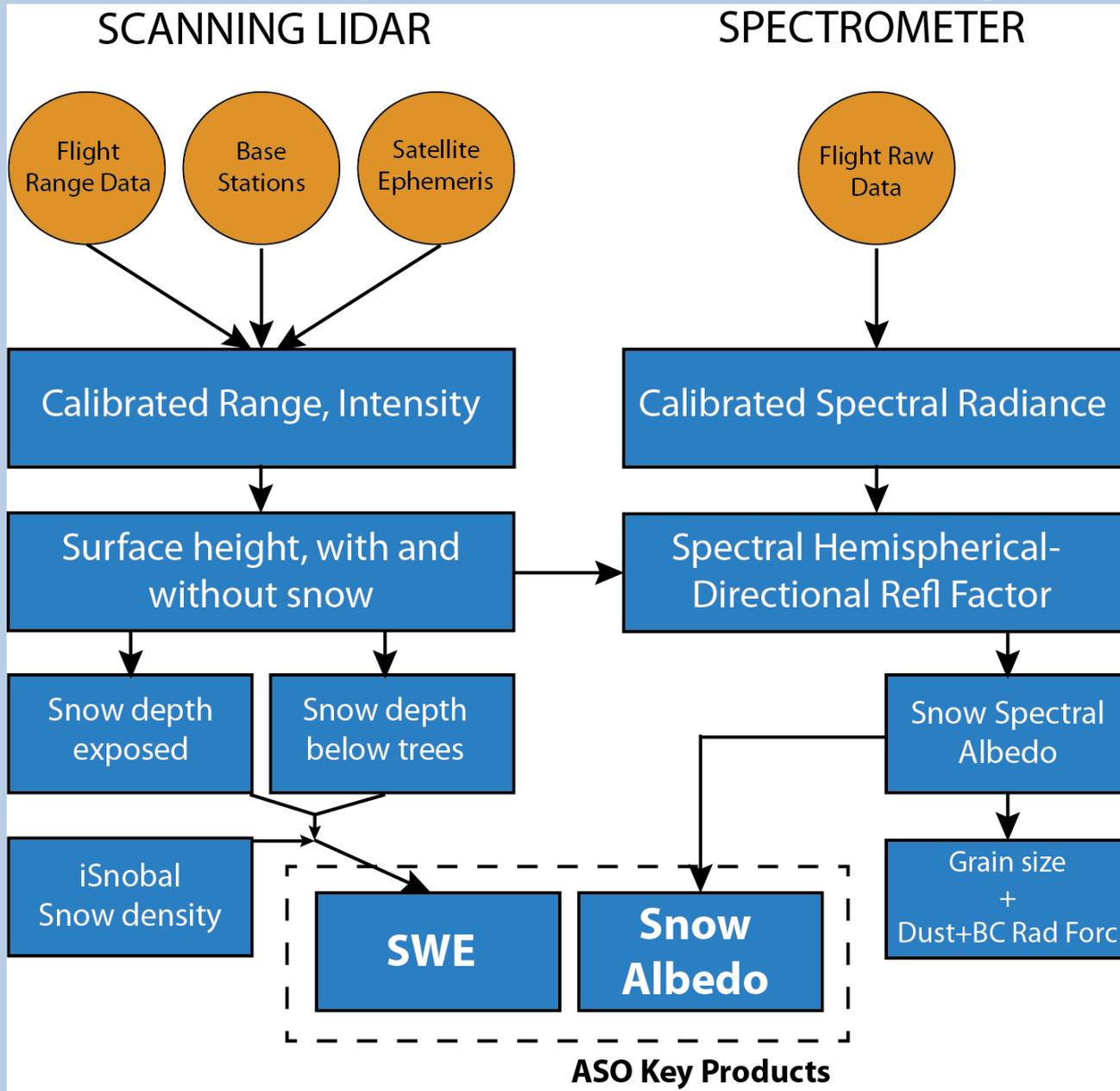


Image USDA Farm Service Agency  
© 2012 Google  
Image © 2012 TerraMetrics  
Image © 2012 GeoEye

Google earth

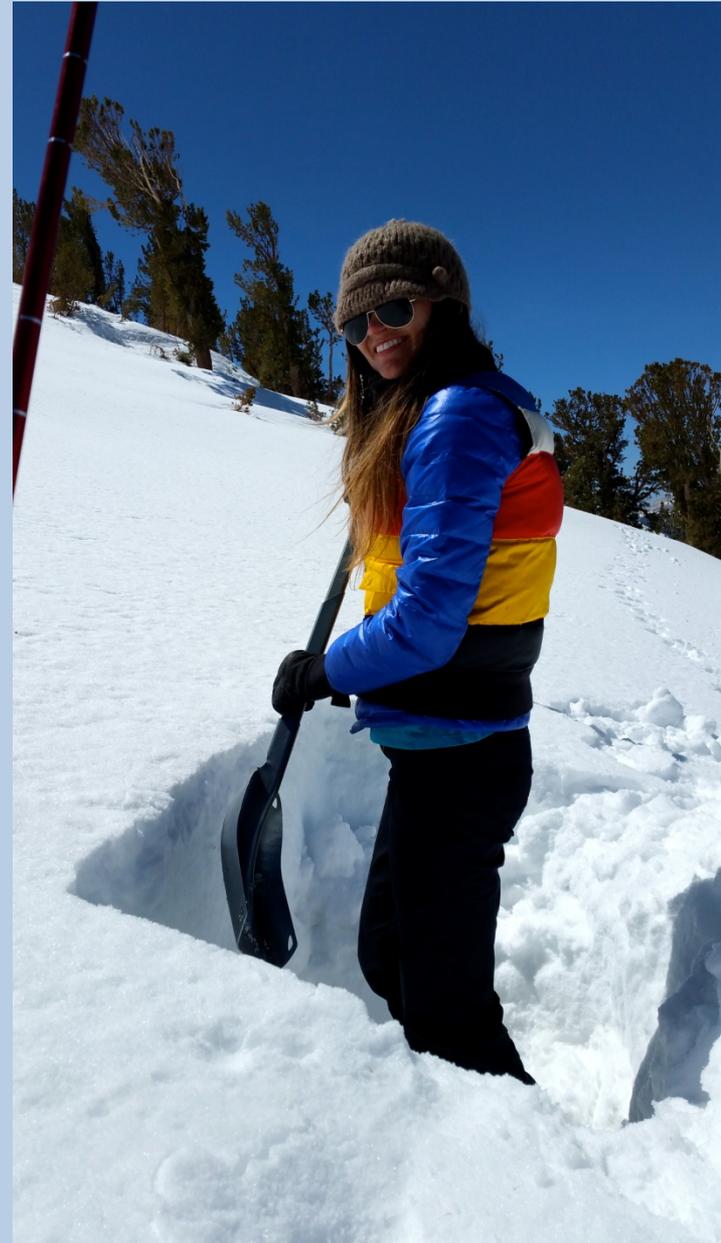
# LiDAR & Spectrometer Pipeline



# Field Data Crucial for ASO SWE

- LiDAR and spectrometer produce distributed snow extent, depth, and albedo grid
- Density grid also needed
- Density changes with elevation and aspect, and over time during the snow season
- iSNOBAL model used to generate density grid
- **FIELD DATA CRITICAL TO CONSTRAIN iSNOBAL**

# ASO Field Campaigns



# Gin Flat Field Work, 2013



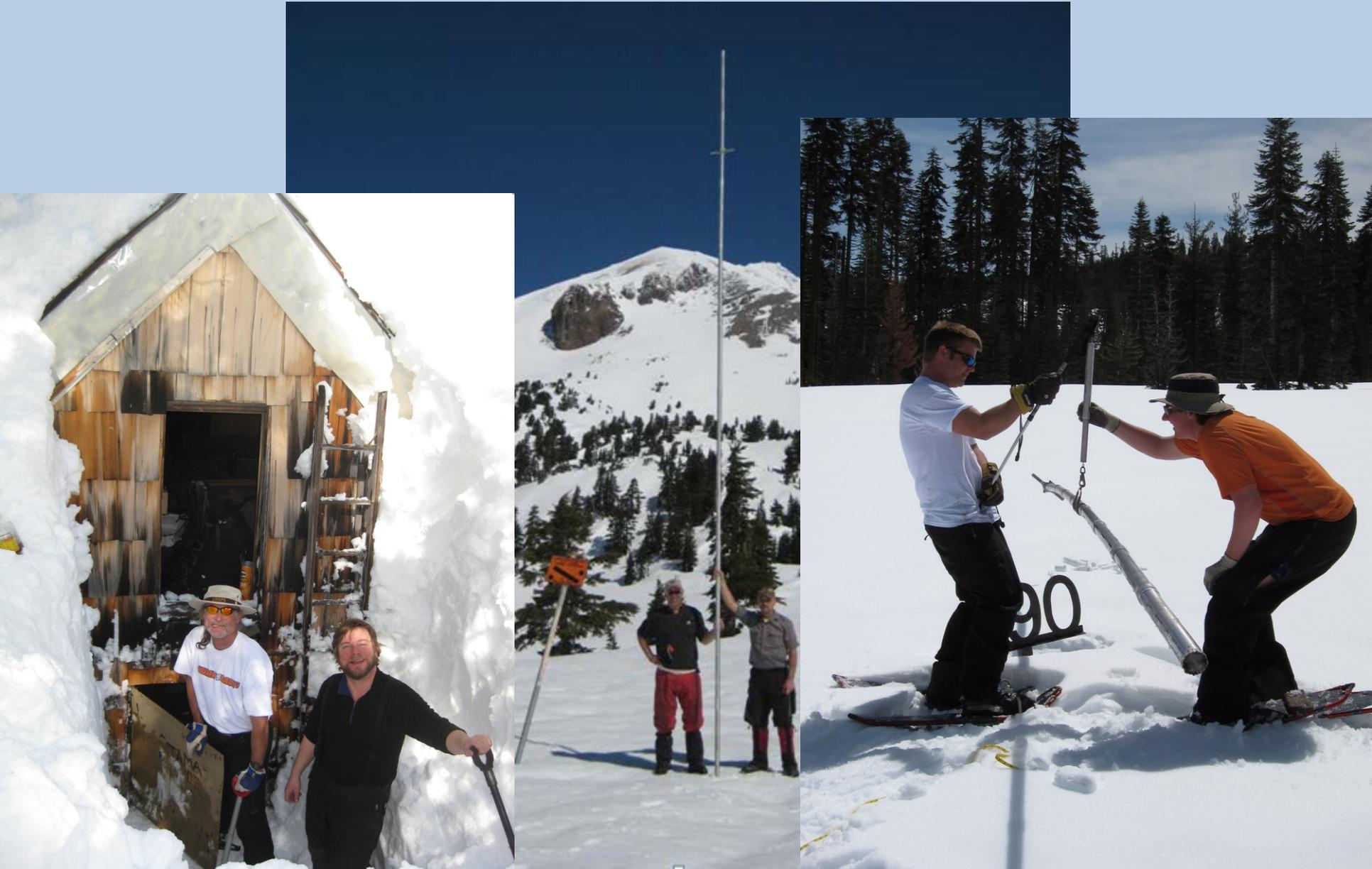
# TLS Surveys, 2014



# Density Sampling, Tuol. – 2015



# Snow Surveyor's Data is Crucial



# Senior CA Officials Recruited, 2015



Questions?

