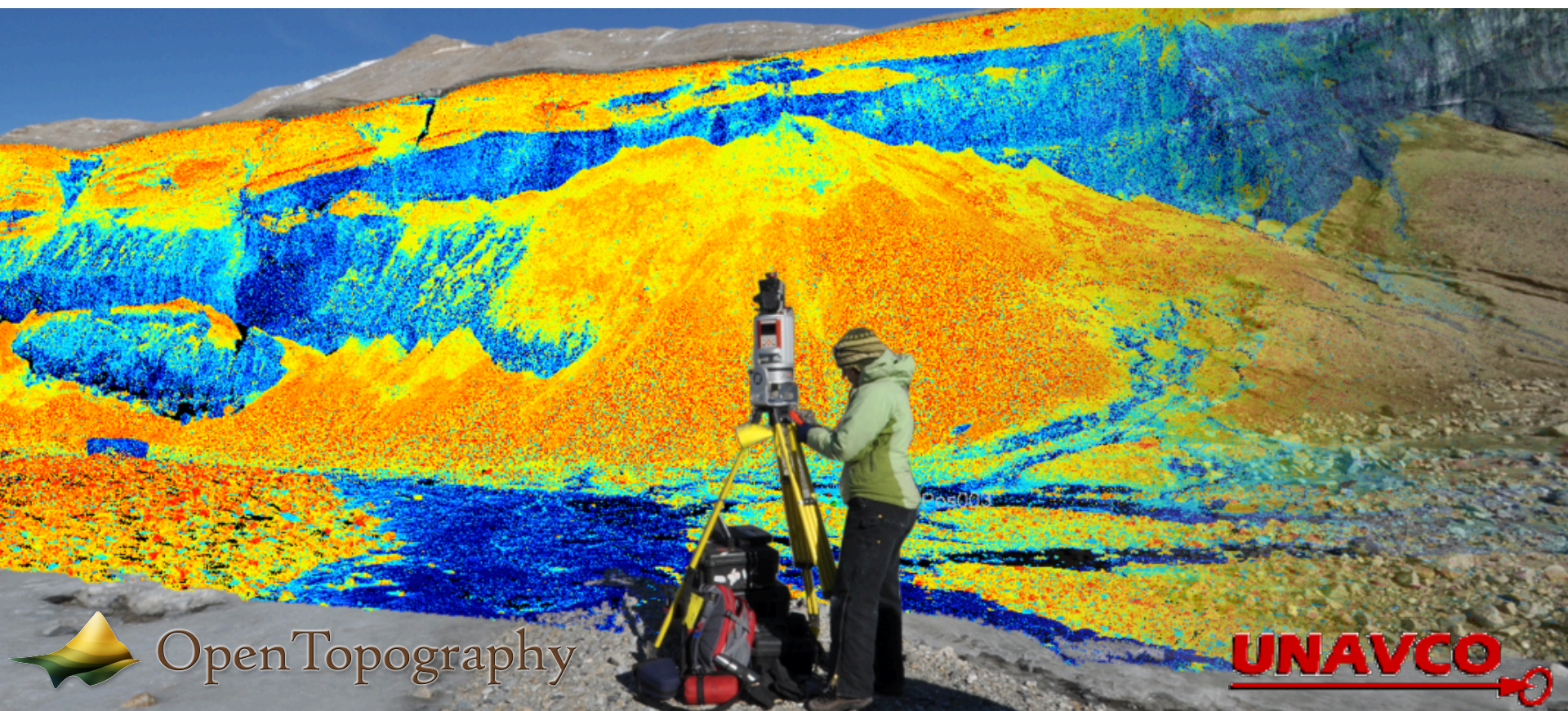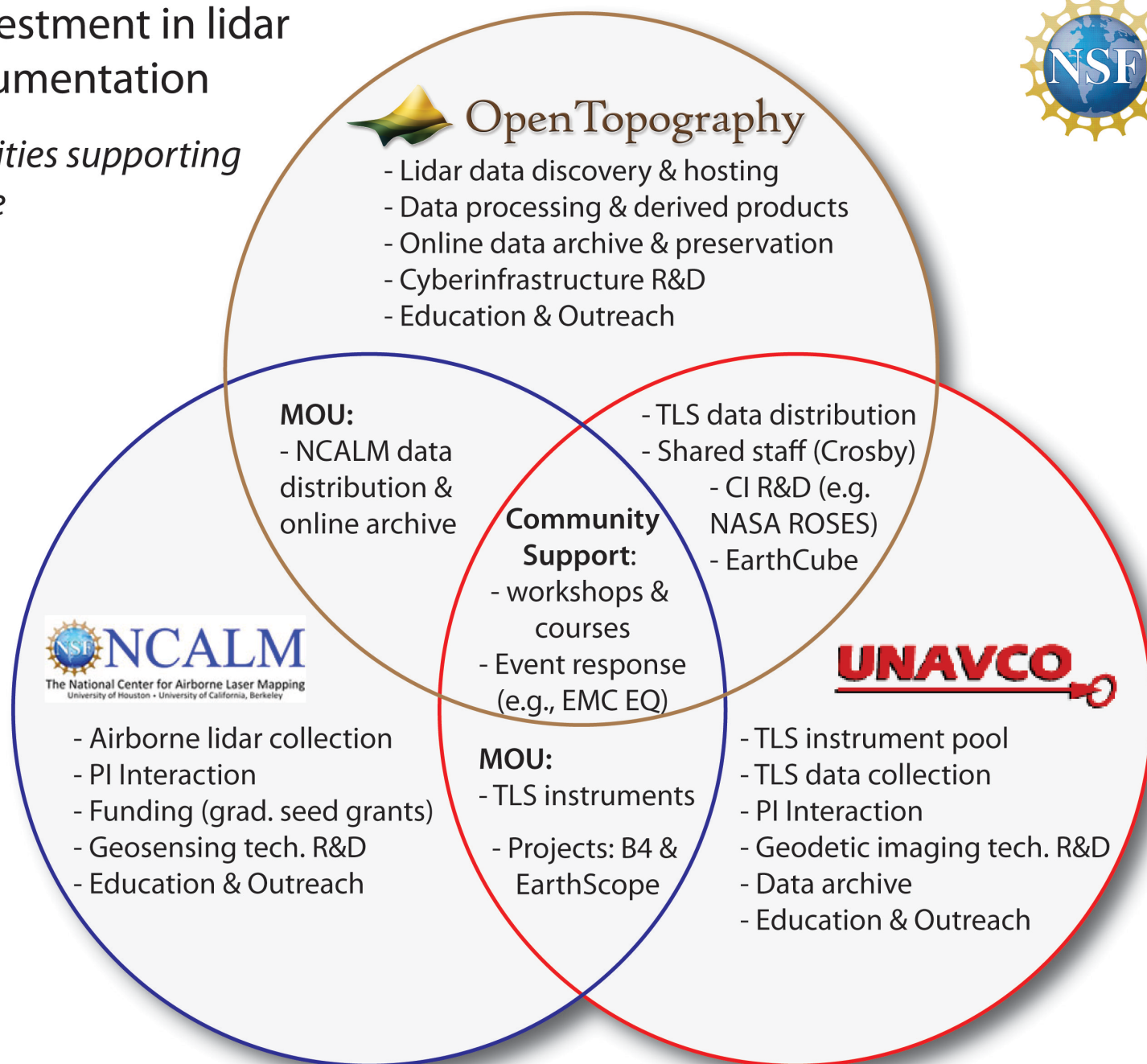# Facilitating Access to High-Resolution Topography: Data Collection Support and Online Data Distribution

Christopher Crosby
UNAVCO & OpenTopography

NSF EAR IF investment in lidar data and instrumentation

Cooperative facilities supporting NSF earth science

UNAVCO is a <u>non-profit</u>, membership governed <u>consortium</u> of universities that facilitates geoscience research and education using <u>geodesy</u>.

UNAVCO supports <u>GPS</u>, <u>InSAR</u> and <u>LiDAR</u> data acquisition, data archiving, equipment, development & testing, training.

UNAVCO operates and maintains the **Plate Boundary Observatory** network of instruments.

UNAVCO Education & Community Engagement works to promote a broader understanding of Earth science.
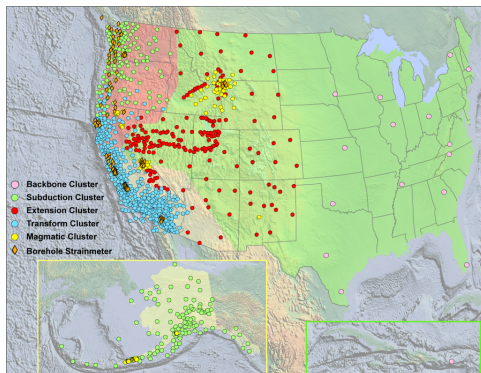
Technical Support

- Instrumentation (6 scanners)
- Field engineering
- Basic data processing
- Data archiving

Community Building

- Community workshops
- Community partnerships
- Inter-Agency collaborations

Education and Community Engagement

- Training short courses
- TLS in field camp
- RESESS internships

COMMUNITY WORKSHOP ANNOUNCEMENT

Charting the Future of Terrestrial Laser Scanning (TLS) in the Earth Sciences

Boulder, Colorado, USA. October 17-19, 2011
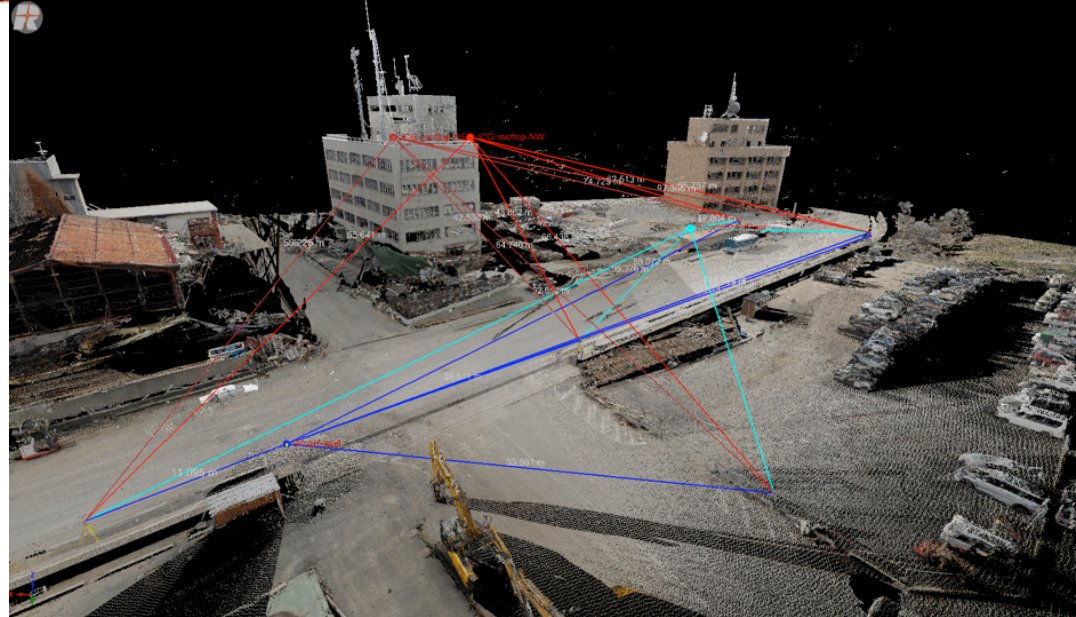Information and registration: www.unavco.org

TLS survey of Arenal Volcano, Costa Rica (PI, A. NEWMAN)

Before & during field work:

- Planning
  - Survey logistics & instrument selection

- Instrument validation

- Data collection
  - UNAVCO field engineer oversees data collection

Post-field work:

- Initial data processing = Merged, aligned, georeferenced pt cloud

- Archiving
  - Inc. raw lidar and gps, field photos, metadata

- Software – remote license access and processing machines

- Guidance on data processing and analysis, software selection

UNAVCO TLS Instrument Pool

Scanners funded by the National Science Foundation

- TLS instrument pool = 6 scanners
  - ➤ 3x Riegl VZ400
  - ➤ 1x Riegl VZ1000 (full waveform) *NEW!*
  - ➤ 1x Riegl Z620
  - ➤ 1x Leica C10

- Campaign and RTK GPS, tripods, various power supply options

- Instrument validation range

- License server w/ access to RiScan Pro, Cyclone, Polyworks, ArcGIS, Quick Terrain Modeler, MatLab, etc
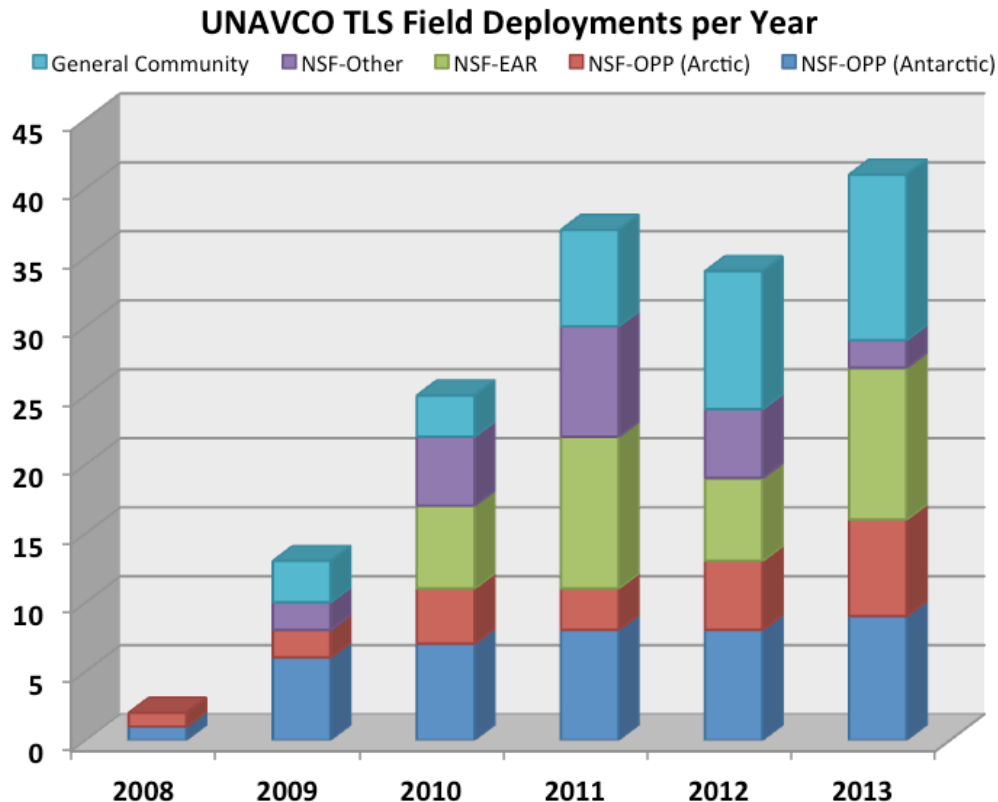
	Riegl VZ-1000	Riegl VZ-400	Riegl Z620	Leica C10
Laser Wavelength	1550 nm (near IR)	1550 nm (near IR)	1550 nm (near IR)	532 nm (green)
Effective Range (max)	1400 m	500 m	2000 m	150 m
High-speed meas. rate	122,000 points/sec	125,000 points/sec	11,000 points/sec	50,000 points/sec
Precision	5 mm	5 mm	10 mm	4 mm
Accuracy	8 mm	5 mm	10 mm	6 mm
Field of View	100° x 360°	100° x 360°	80° x 360°	270° x 360°
Dimensions	308mm x 180mm	308mm x 180mm	463mm x 210mm	238mm x 395mm
Weight	9.8kg	9.8kg	16kg	13 kg

UNAVCO TLS Support Costs:

- For NSF-supported projects, PI pays field engineer travel and equipment shipping.

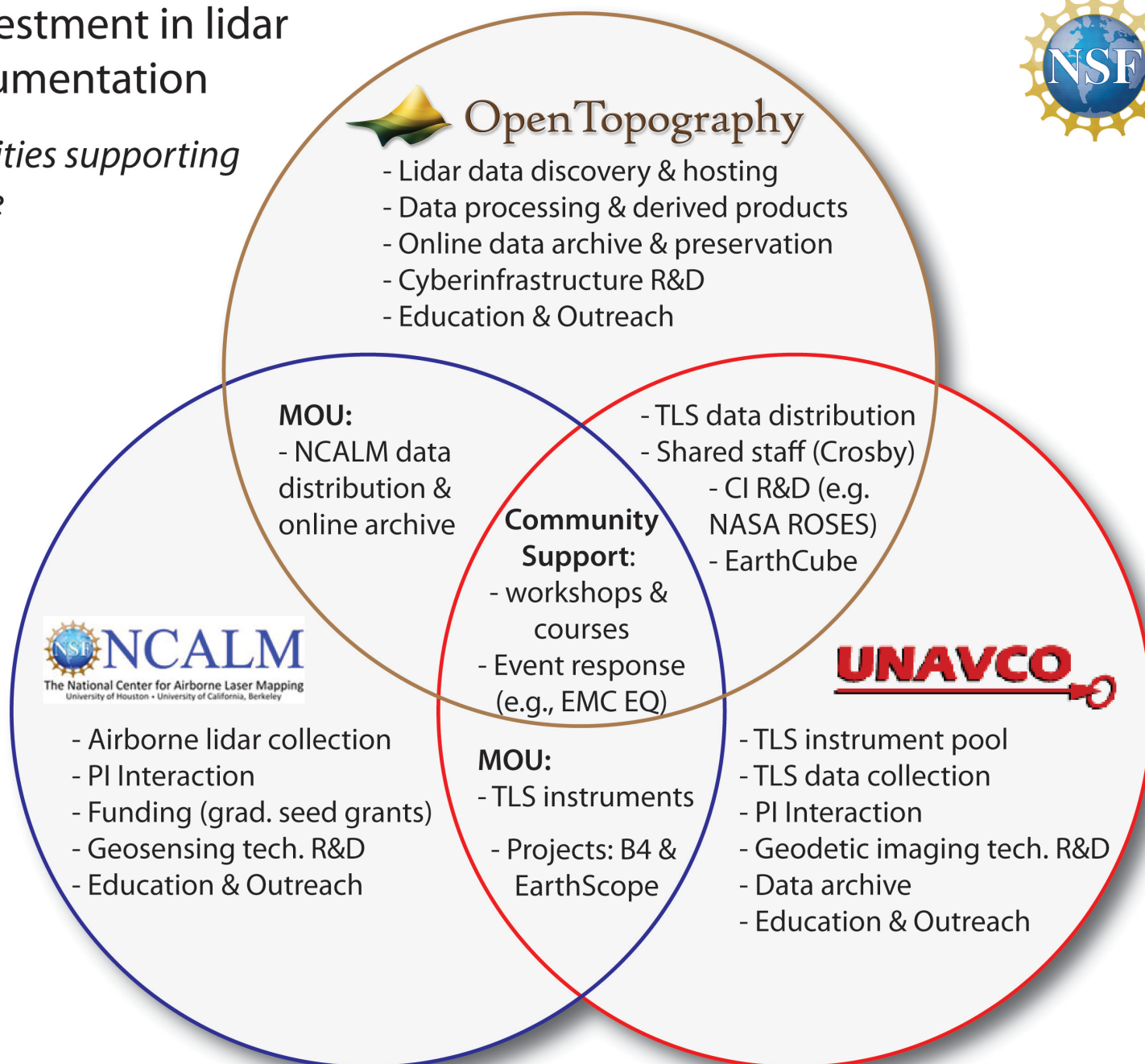- For non-NSF supported work, full cost recovery required.

Project Prioritization:

- UNAVCO sponsors = NSF-EAR and NSF-OPP = highest priority.

- NSF-other and non-NSF = projects supported as resources allow.
    - ➢ *Schedule flexibility helps*

UNAVCO TLS Field Deployments per Year

Legend: General Community, NSF-Other, NSF-EAR, NSF-OPP (Arctic), NSF-OPP (Antarctic)

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OpenTopography

- Lidar data discovery & hosting
- Data processing & derived products
- Online data archive & preservation
- Cyberinfrastructure R&D
- Education & Outreach

MOU:
- NCALM data distribution & online archive

- TLS data distribution
- Shared staff (Crosby)
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NCALM
The National Center for Airborne Laser Mapping
University of Houston • University of California, Berkeley

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MOU:
- TLS instruments

- Projects: B4 & EarthScope

UNAVCO

- TLS instrument pool
- TLS data collection
- PI Interaction
- Geodetic imaging tech. R&D
- Data archive
- Education & Outreach

NCALM

THE NATIONAL CENTER FOR AIRBORNE LASER MAPPING

- Based at University of Houston & University of CA, Berkeley

- Funded by NSF EAR-IF program. Initiated in 2003, funded through 2018.

- Cessna 337 Skymaster w/ GEMINI 167 kHz IR topographic & AQUARIUS Green bathymetric/ topographic LiDAR,

- Collect data for NSF-funded researchers. Cost integrated into proposal budgets.

- *Seed grant* program provides 40km^2 of data for graduate students through annual proposal process.

Research grade datasets.

Typically 8+ pts/m^2, 0.5 - 1 meter resolution DEMs.

Available Data:

- Data openly available after 2 yrs.

- 116 Datasets

- 22,464 km^2

- 126,313,774,883 LiDAR pts

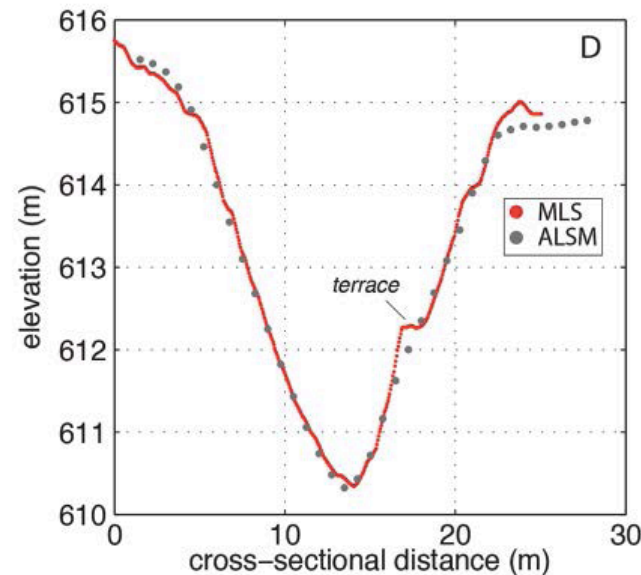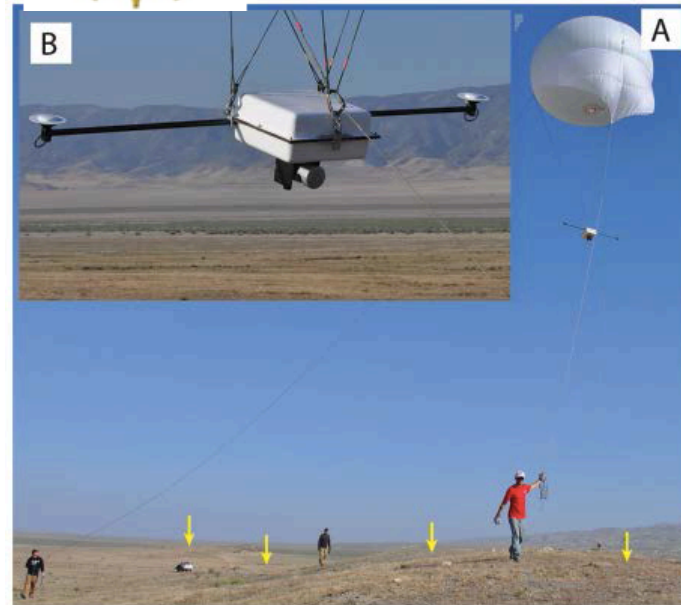- Numerous publications and educational impacts from these data

NCALM

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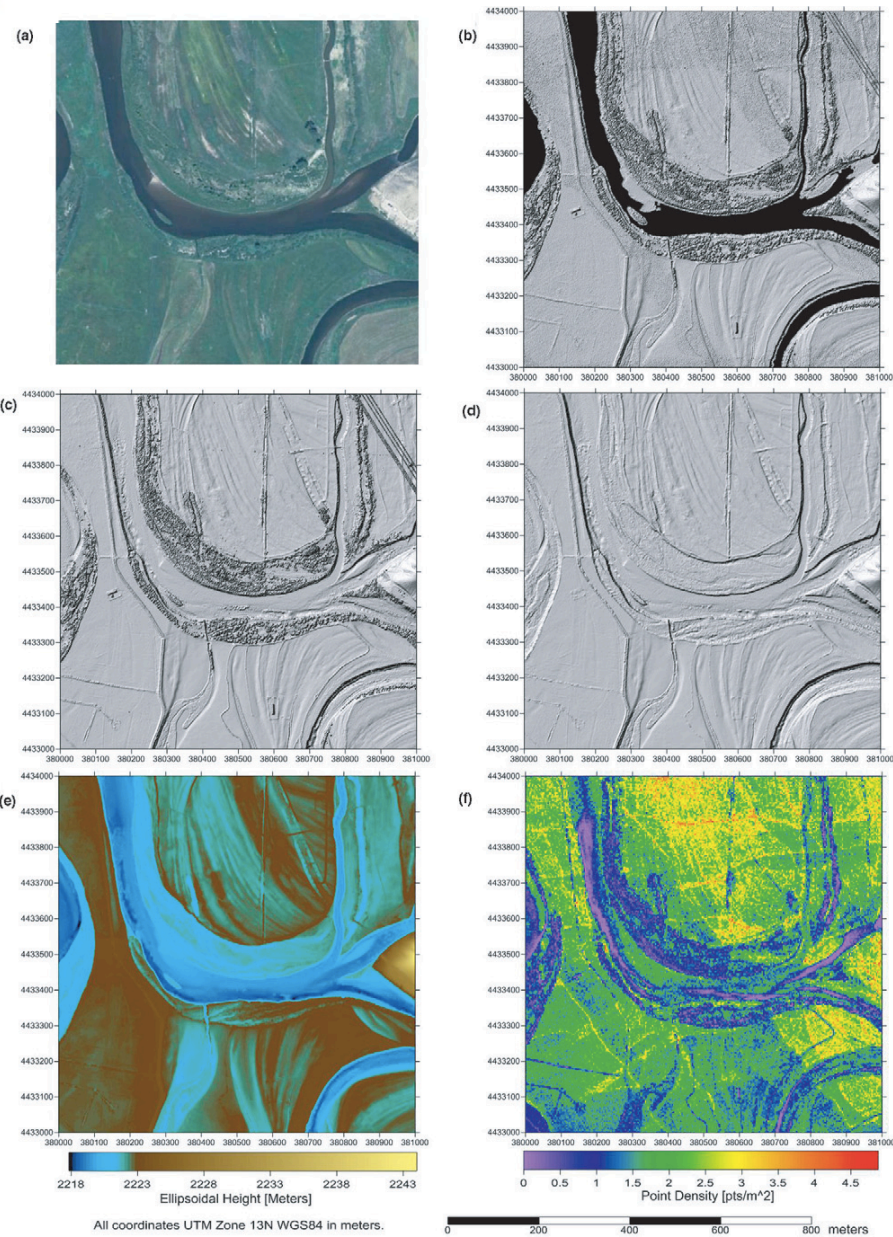
Technology R&D – Mobile Laser Scanning (MLS)

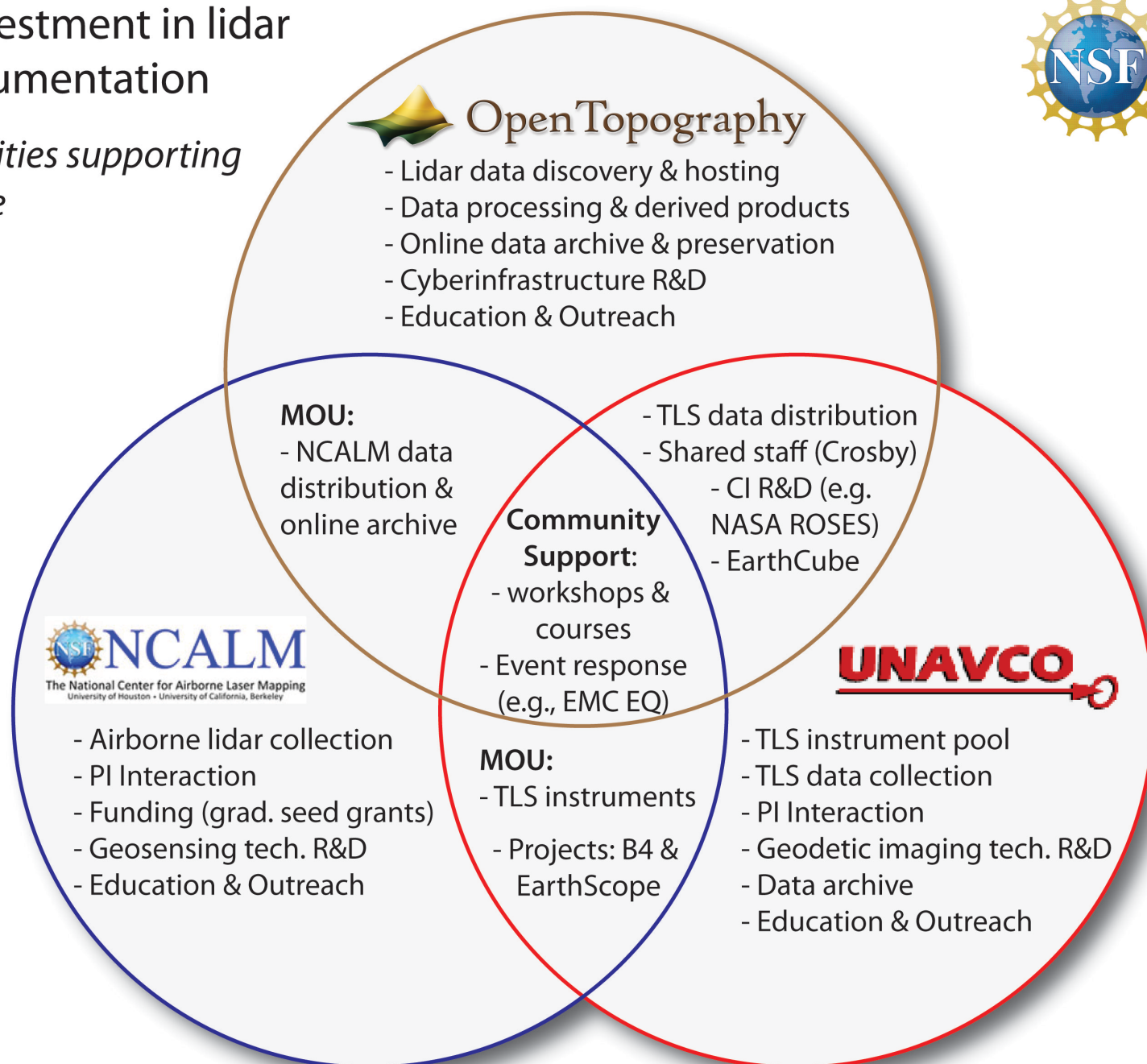*Brooks et al., 2013, Mobile Laser Scanning Applied to the Earth Sciences, Eos, Vol. 94, No. 36*

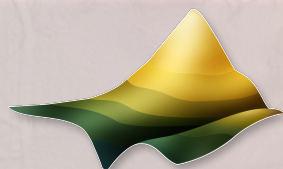"Blidar" – balloon or backpack mounted lidar system.

Compact, quickly deployable, fits in "sweet spot" between ALS and TLS.
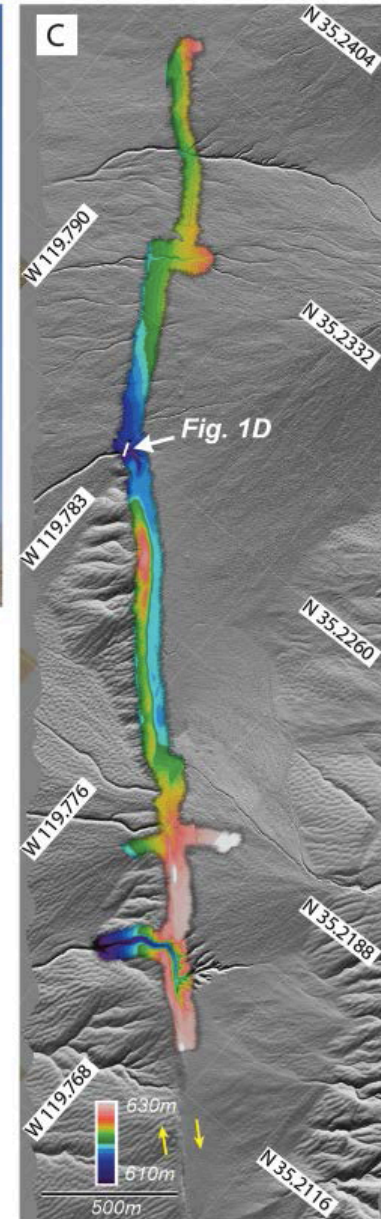
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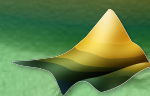
Airborne Lidar Workflow

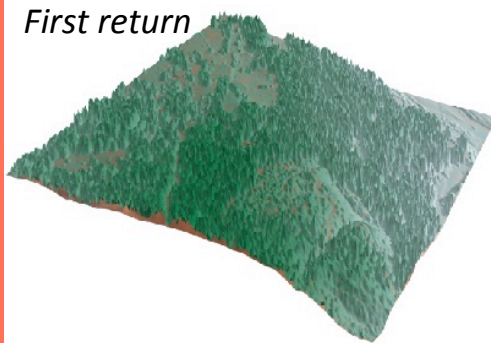1. Acquire
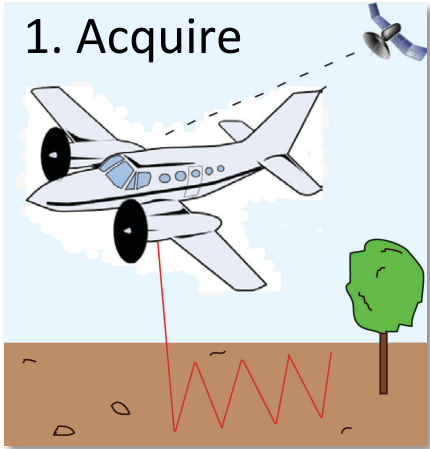
2. Process

Laser + GPS + IMU
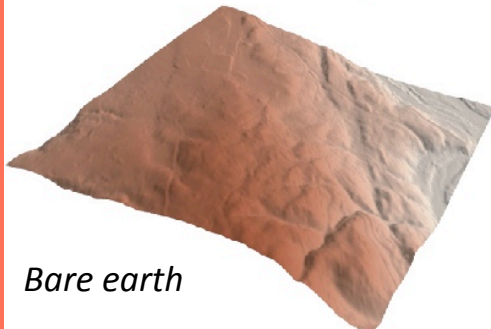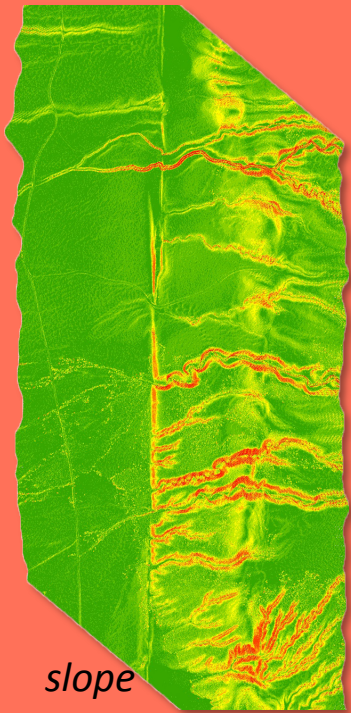
point cloud
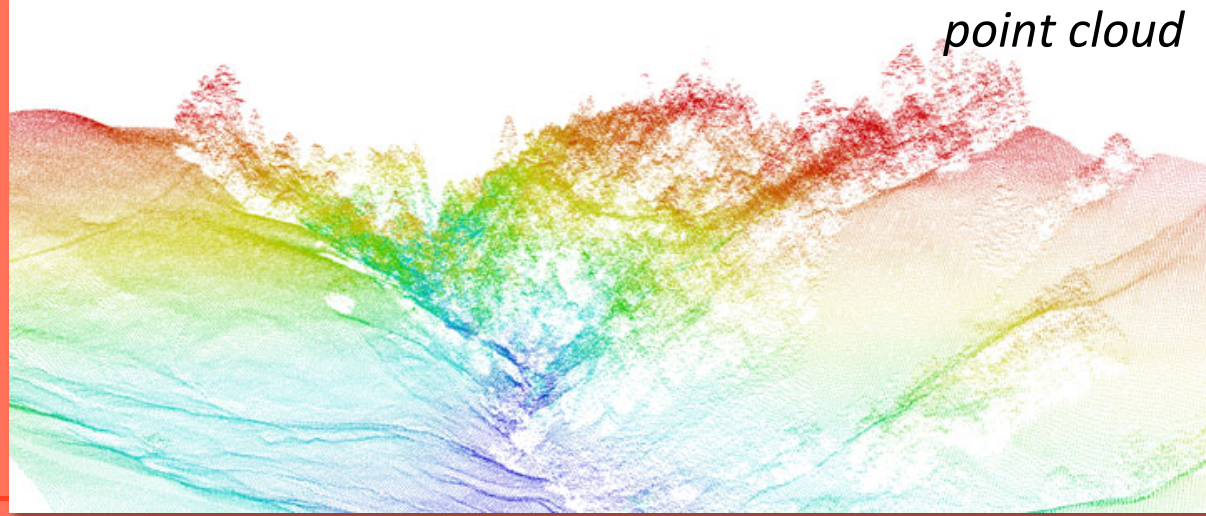
3. Classify (filter)
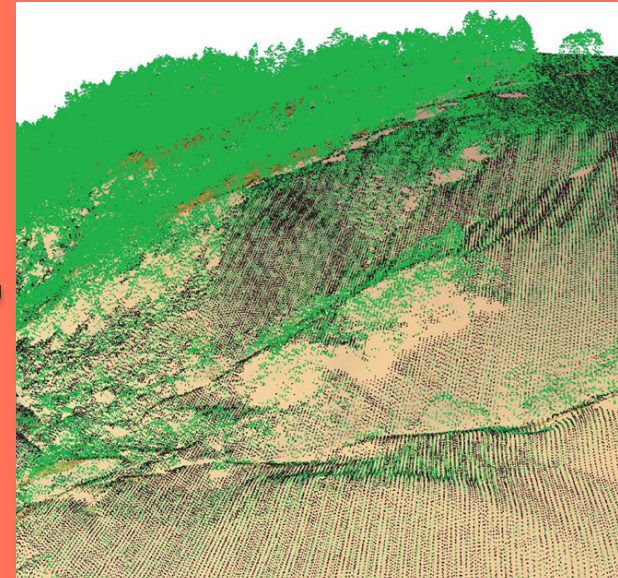
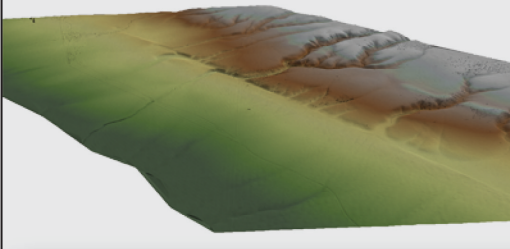4. Grid

First return

Bare earth

5. Generate Derivatives

slope

OpenTopography Multi-Tiered Data Products

Data Volume, Computational Demands ↓
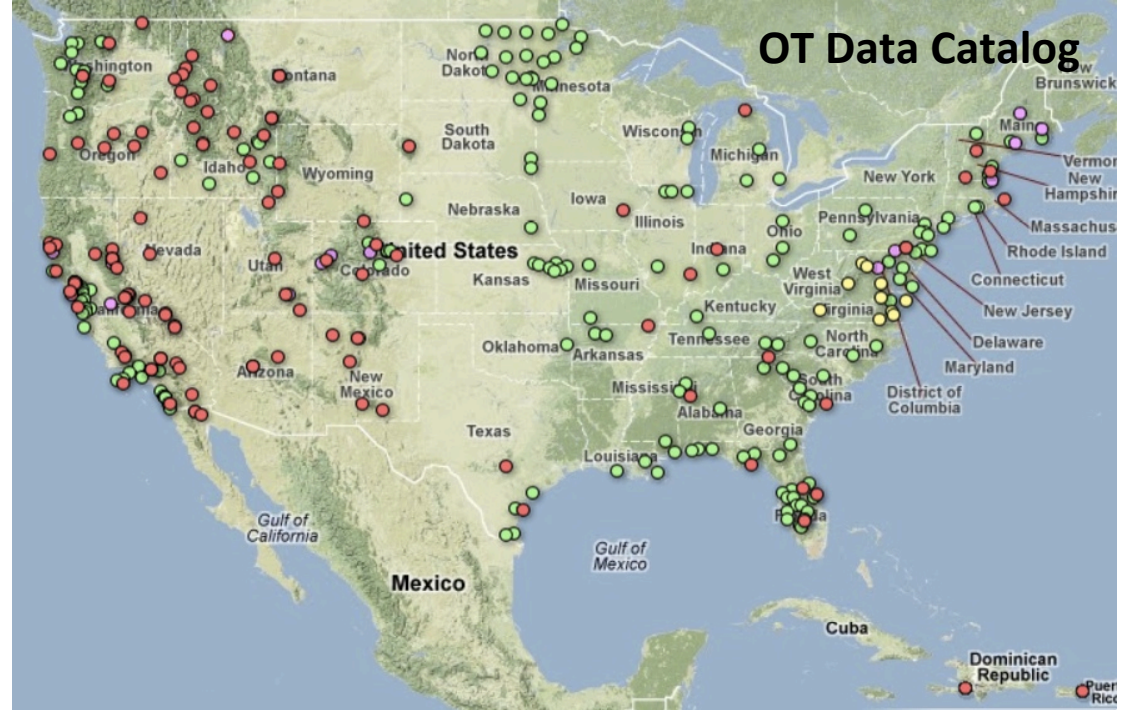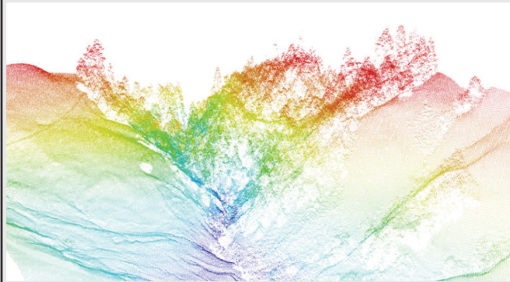
Accessibility / Ease of Use ↑

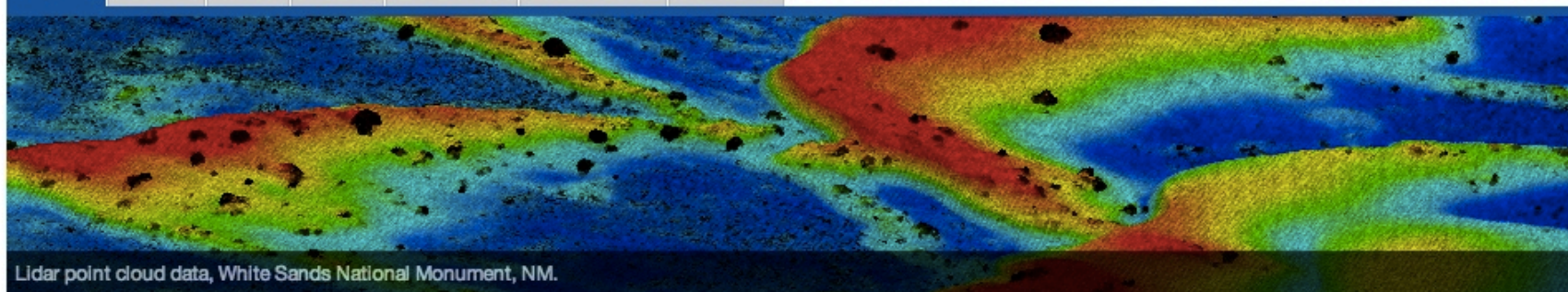**Google Earth (KMZ):** *visualization & synoptic data browsing*
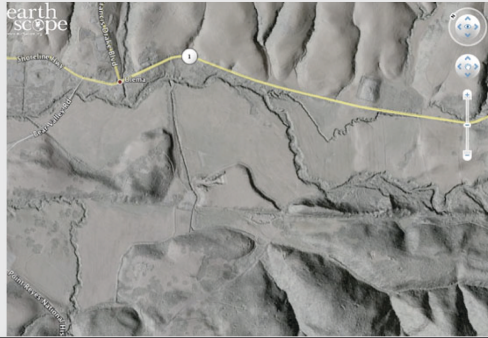
DEMs: *qualitative & quantitative analysis, GIS-users, data integration*

Point Cloud & Custom DEMs: *"raw" data access and fully customized data products*

OT Data Catalog

- Large user community with variable needs and levels of sophistication.

- Goal: maximize access to data to achieve greatest scientific impact.

- Big data – treat data as an asset that can be used and reused

OpenTopography

A Portal to High-Resolution Topography Data and Tools

myOpenTopo

Search

○ Data ○ Tools ● Site

| Home | About | Data | Tools | Education | Community | Support |

Lidar point cloud data, White Sands National Monument, NM.
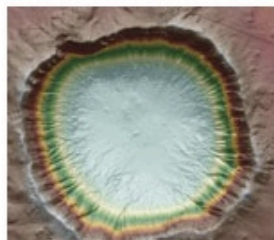
Overview Video   Find Data   Tools   Learn

Spotlight

NSF Renews Funding for OpenTopography

We are happy to announce that the National Science Foundation (NSF) has renewed funding for OpenTopography. The three-year renewal under the National Science Foundation's Geoinformatics and Earth Sciences: Instrumentation and Facilities (EAR-IF) program follows an initial three-year award from EAR-IF and the Office of Cyberinfrastructure, announced in late 2009.

Latest News

OpenTopography at 2013 European Geosciences Union Meeting

Posted: April 07, 2013
OpenTopography will be at the 2013 European Geosciences Union (EGU) Meeting this week in Vienna, Austria and presenting a talk… [more]

10 New Point Cloud Datasets from Brazil, Alaska, California, Montana, North Carolina & Oregon

Connect with OpenTopography

9 days ago: 10 new #lidar datasets posted - data in AK, CA, MT, NC, OR, PA & Brazil, our 1st dataset from the S. Hemisphere: opentopography.org/index.php/news…

Data Summary

Total Coverage: **93,147 km^2**
Total Number of Lidar Returns: **533,927,158,741**

Latest Lidar Datasets:
- Flathead Lake Biological Station, MT (September 2005)
- Mojave Desert, CA: Evolution of the Hector Mine Earthquake Surface Rupture
- North Sister, OR: Collier Cone Lava Flow
- Coastal Dune Fields of Garopaba and Vila Nova, Santa Catarina State, Brazil
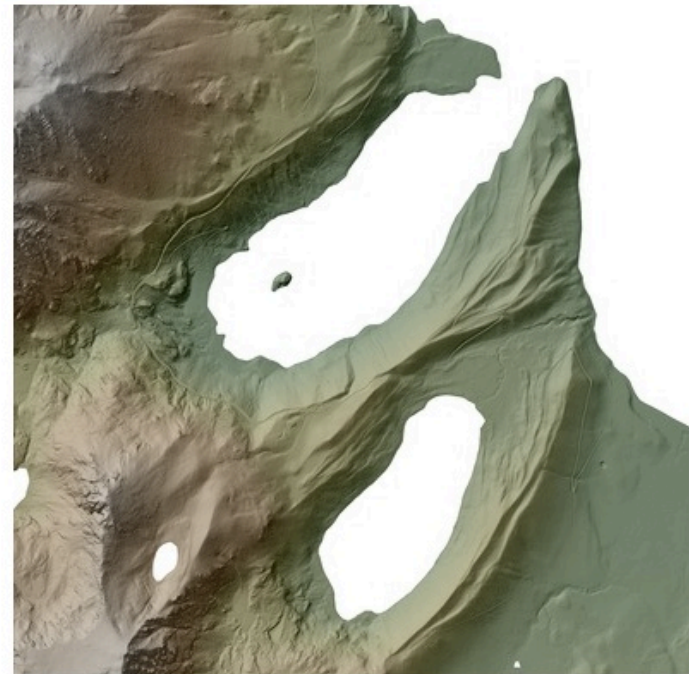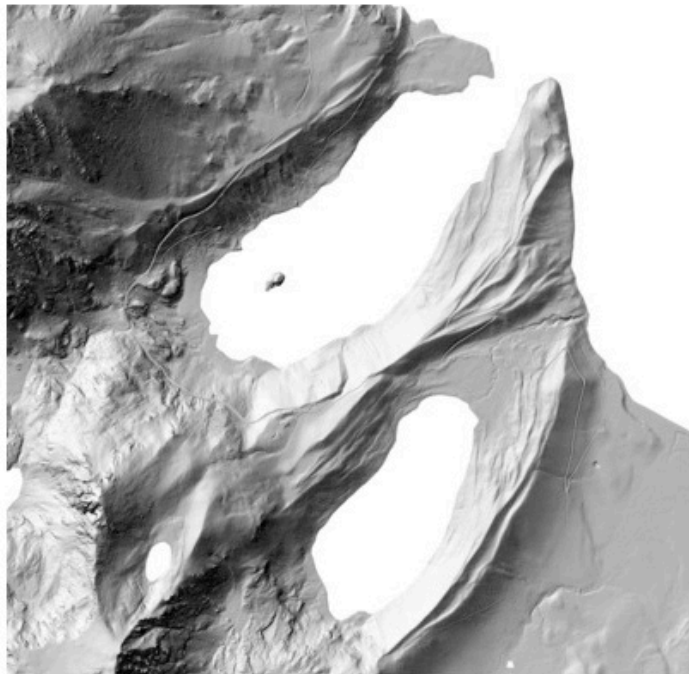
Ztin DEM:

Download KMZ file: viz.tin.hs.kmz
View with Google Earth browser plug-in

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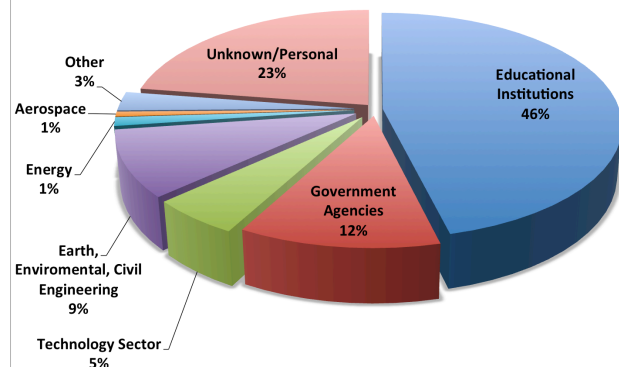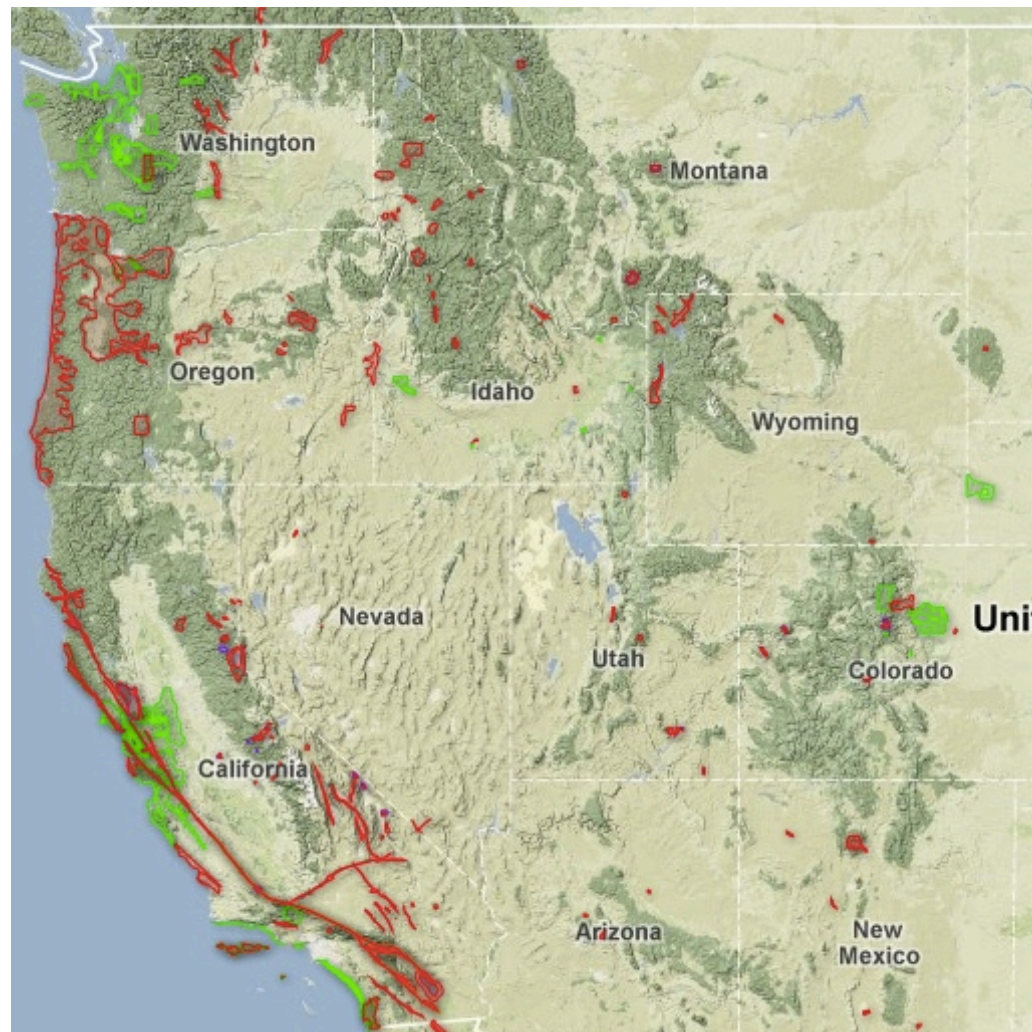SYSTEM STATUS

Data Status

- ~600 billion LIDAR returns

- 158 datasets

- 120,407 km^2

MOUs & Partnerships

NSF: NCALM, UNAVCO, CZOs, LTER

Other: World Bank, Tahoe Regional Planning Authority, Teton Conservation District, Oregon Lidar Consortium, Idaho Lidar Consortium, …

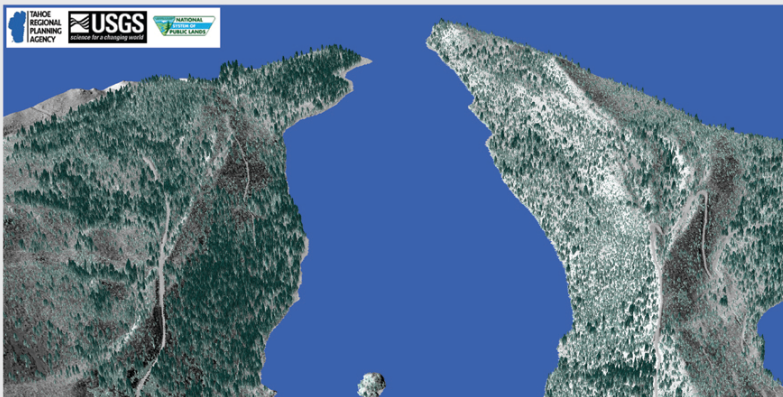*Service Agreements*: State of Indiana Watershed Sciences Inc (for PG&E)

Diverse user base for these data, 3470 registered users, 21,000+ jobs, >30 billion pts/month downloaded.

LiDAR imagery (hillshade and canopy height in green) of Emerald Bay, Lake Tahoe Basin, CA/NV
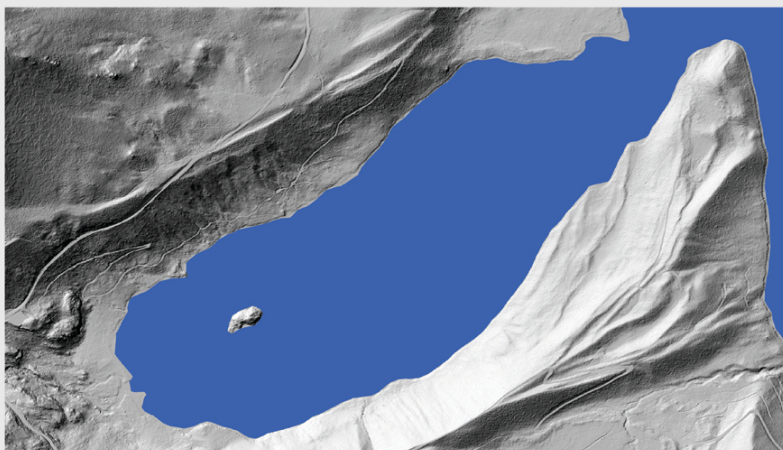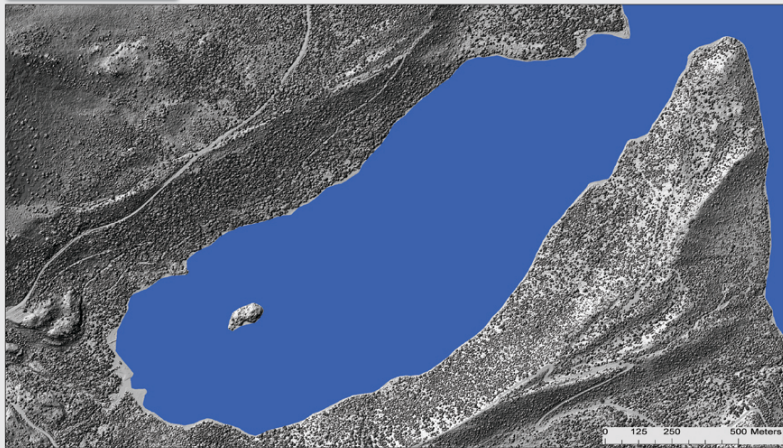
Conclusions:

OT = excellent example of enabling access to challenging data for research, education and outreach.

Growing partnerships with data providers in the academic, governmental and commercial domains

- *Japanese partners?*

Future R&D focused on leveraging next generation computing resources, and integration of community processing tools.

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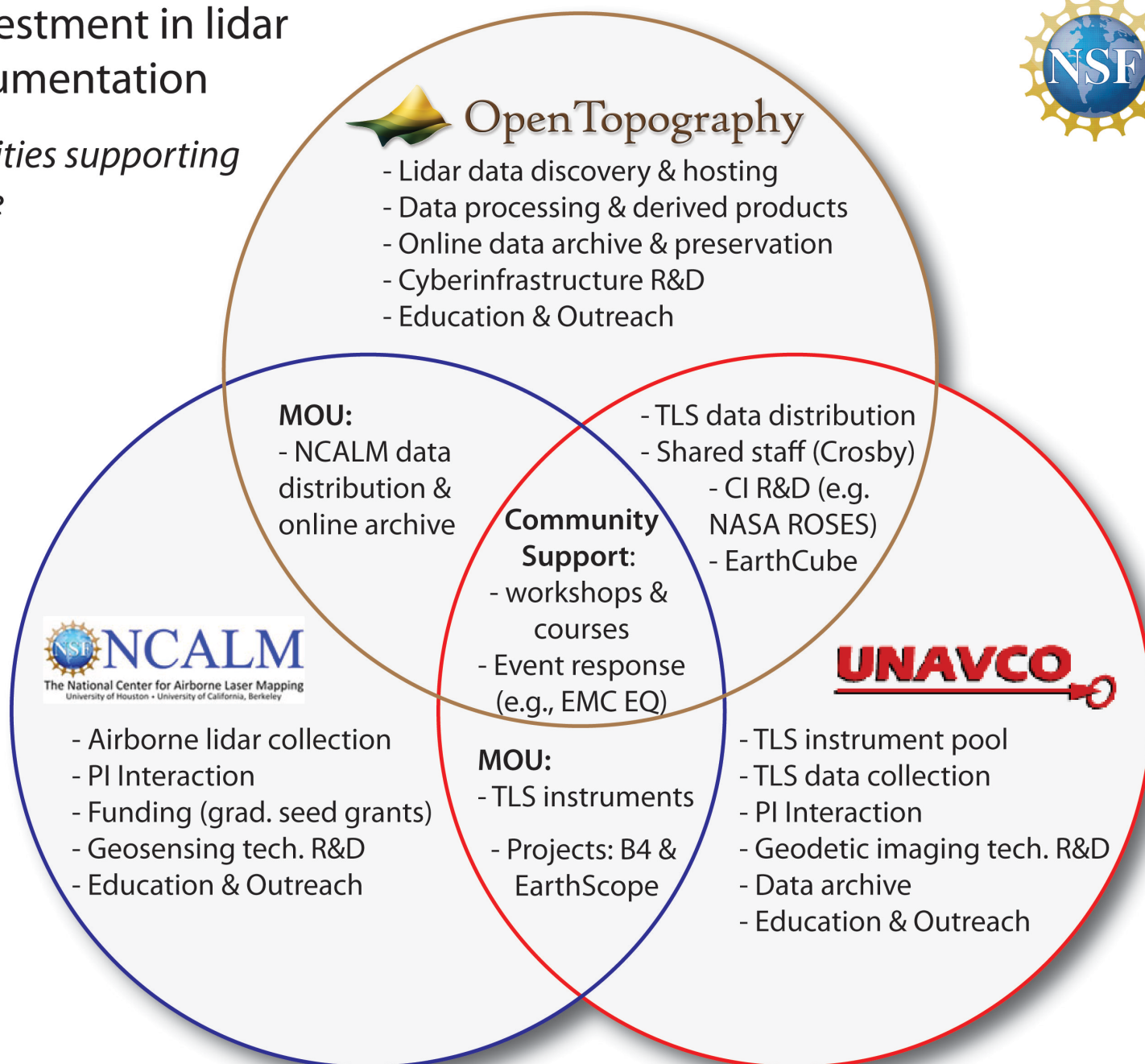- Data processing & derived products
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Links:

http://opentopography.org/
http://unavco.org/tls
http://www.ncalm.org

@OpenTopography

Facebook.com/
OpenTopography

email: crosby@unavco.org

OpenTopography

High Resolution Topography Data and Tools

www.opentopography.org

UNAVCO