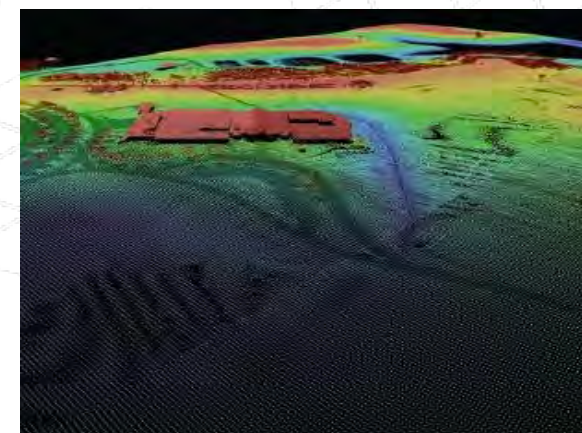
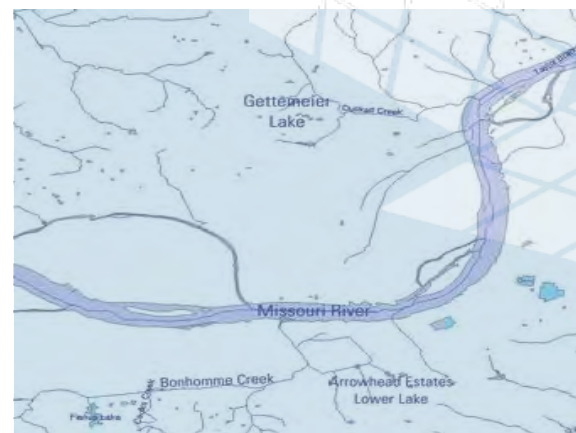
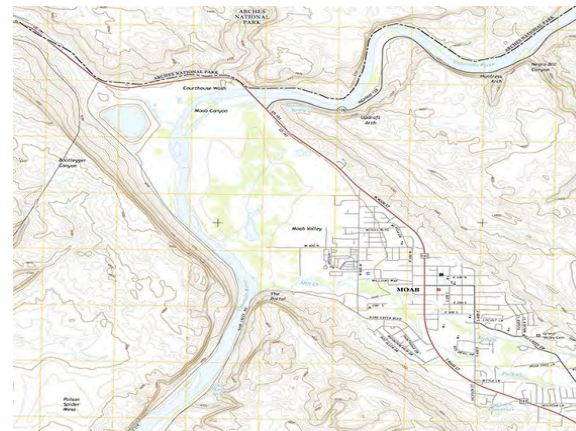




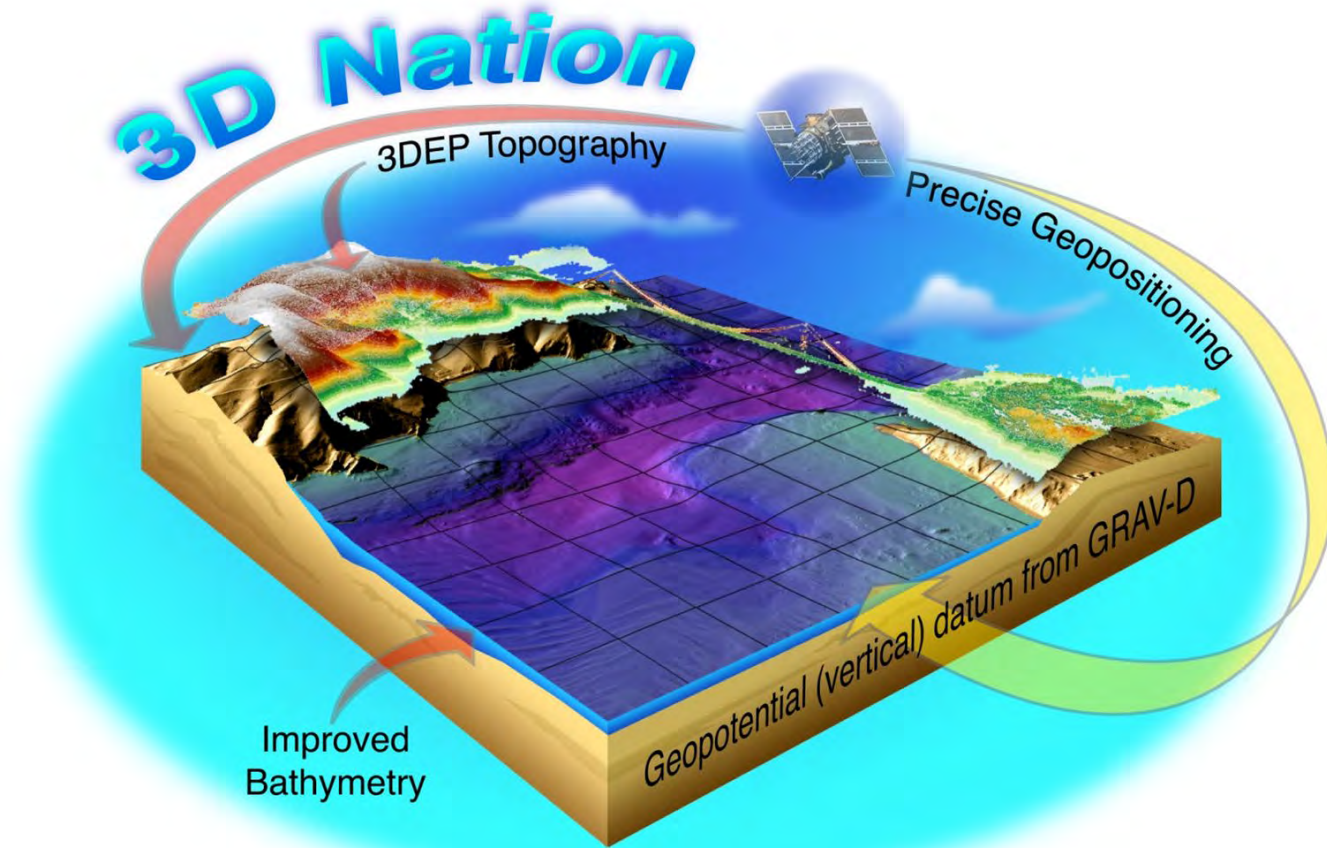
3DEP Introduction for IGC-EC



Jason Stoker, PhD
Acting Chief, USGS NGP Topographic Data Services
November 19, 2020

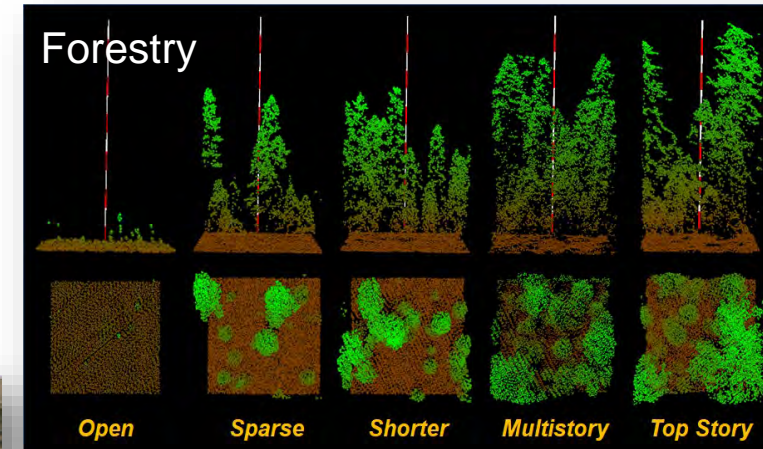
+ The 3D Nation Concept

Building a modern elevation foundation – from the peaks of our mountains to the depths of our waters – for stronger, more resilient communities and U.S. economy

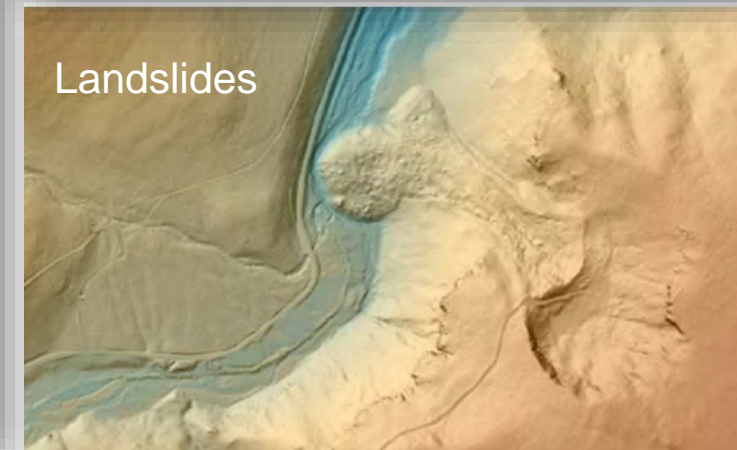


+ 3D Elevation Program (3DEP) Goal

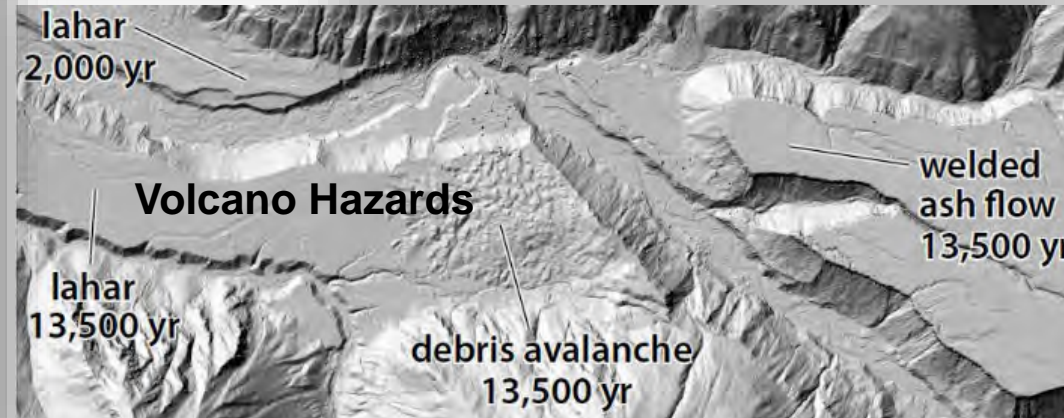
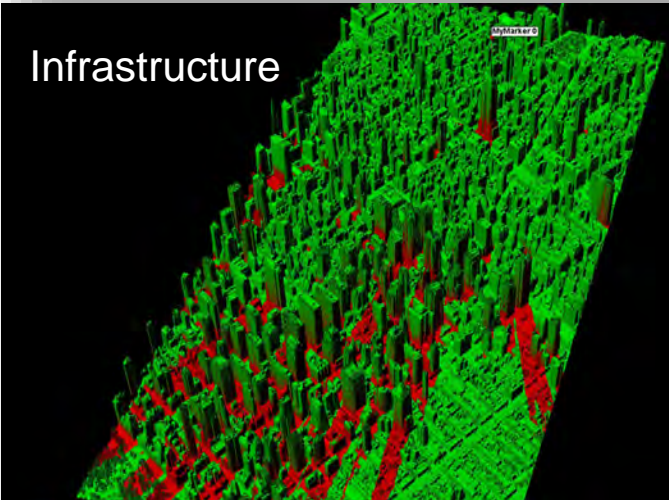
Complete acquisition of nationwide lidar (IfSAR in AK) by 2023 to provide the first-ever national baseline of consistent high-resolution elevation data collected in a timeframe of less than a decade



3DEP as Foundational Data Baselining Conditions

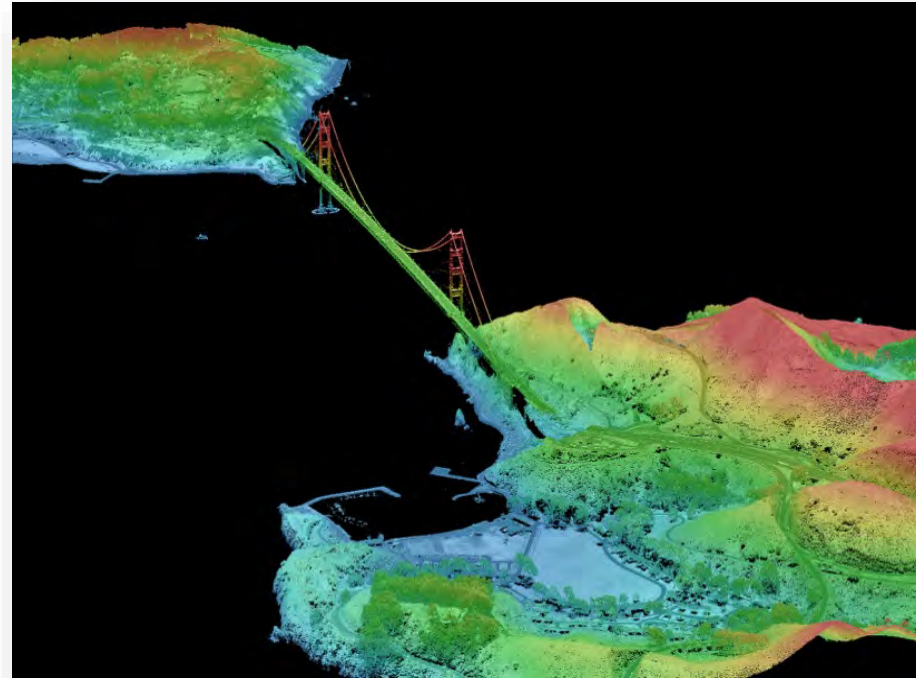


Infrastructure



+ USGS Lidar Base Specification v2.0

- All 3DEP projects are required to adhere to the specification
- All GPSC task orders reference the specification
- Specification covers
 - Definitions of Quality Level
 - Vertical Accuracy
 - Classification Scheme
 - Ground conditions
 - MUCH MUCH MORE!



www.usgs.gov/3DEP/lidarspec

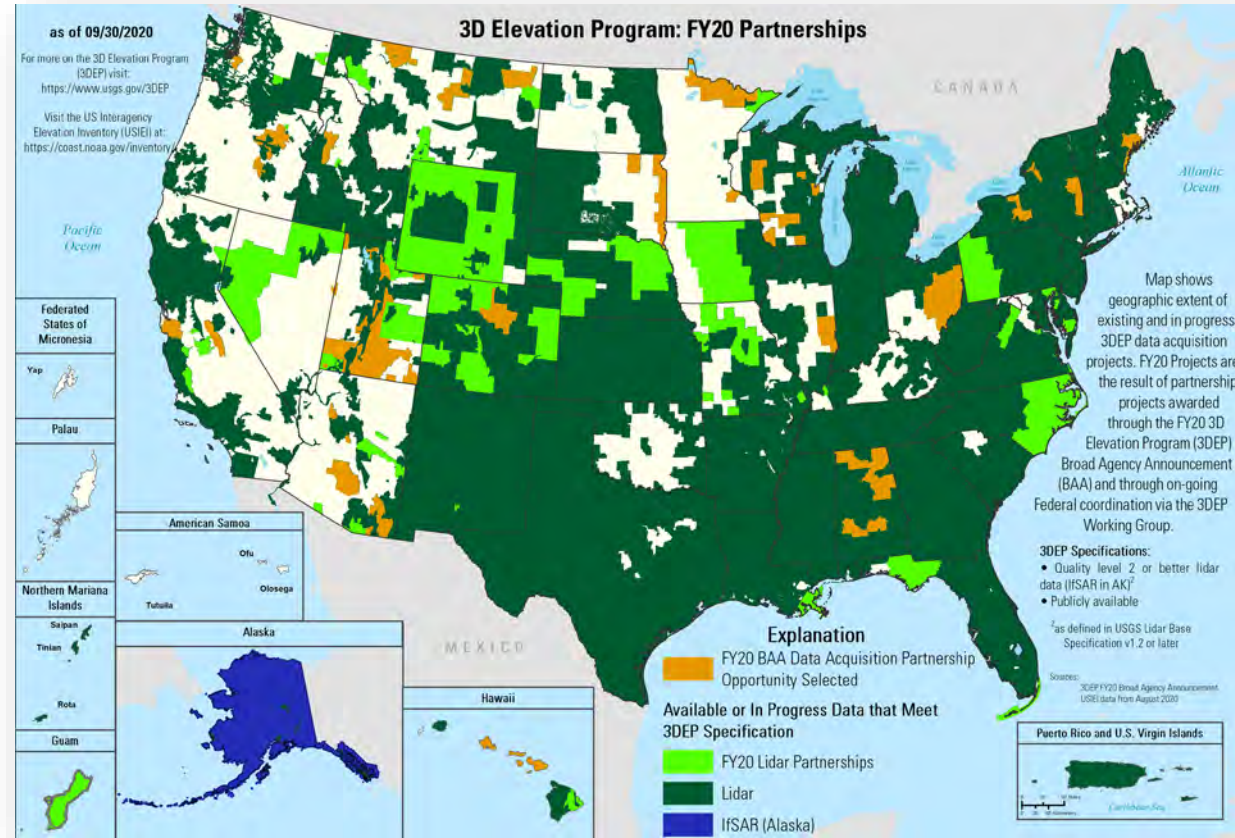
3DEP Quality

- Quality Level 2 or better

Quality Level	Data Source	Vertical Accuracy RMSEz (cm)	Nominal Pulse Spacing (NPS) (meters)	Nominal Pulse Density (NPD) (points per square meter)	Digital elevation mode (DEM) cell size (meters)
QL0	Lidar	5 cm	≤ 0.35 m	≥ 8 pts/meter ²	0.5 m
QL1	Lidar	10 cm	≤ 0.35 m	≥ 8 pts/meter ²	0.5 m
QL2	Lidar	10 cm	≤ 0.7 m	≥ 2 pts/meter ²	1 m
QL3	Lidar	20 cm	≤ 1.4 m	≥ 0.5 pts/meter ²	2 m
QL4	Imagery	139 cm	N/A	N/A	5 m
QL5	lfsar	185 cm	N/A	N/A	5 m

+

3DEP FY20 Acquisition Summary of Partnerships



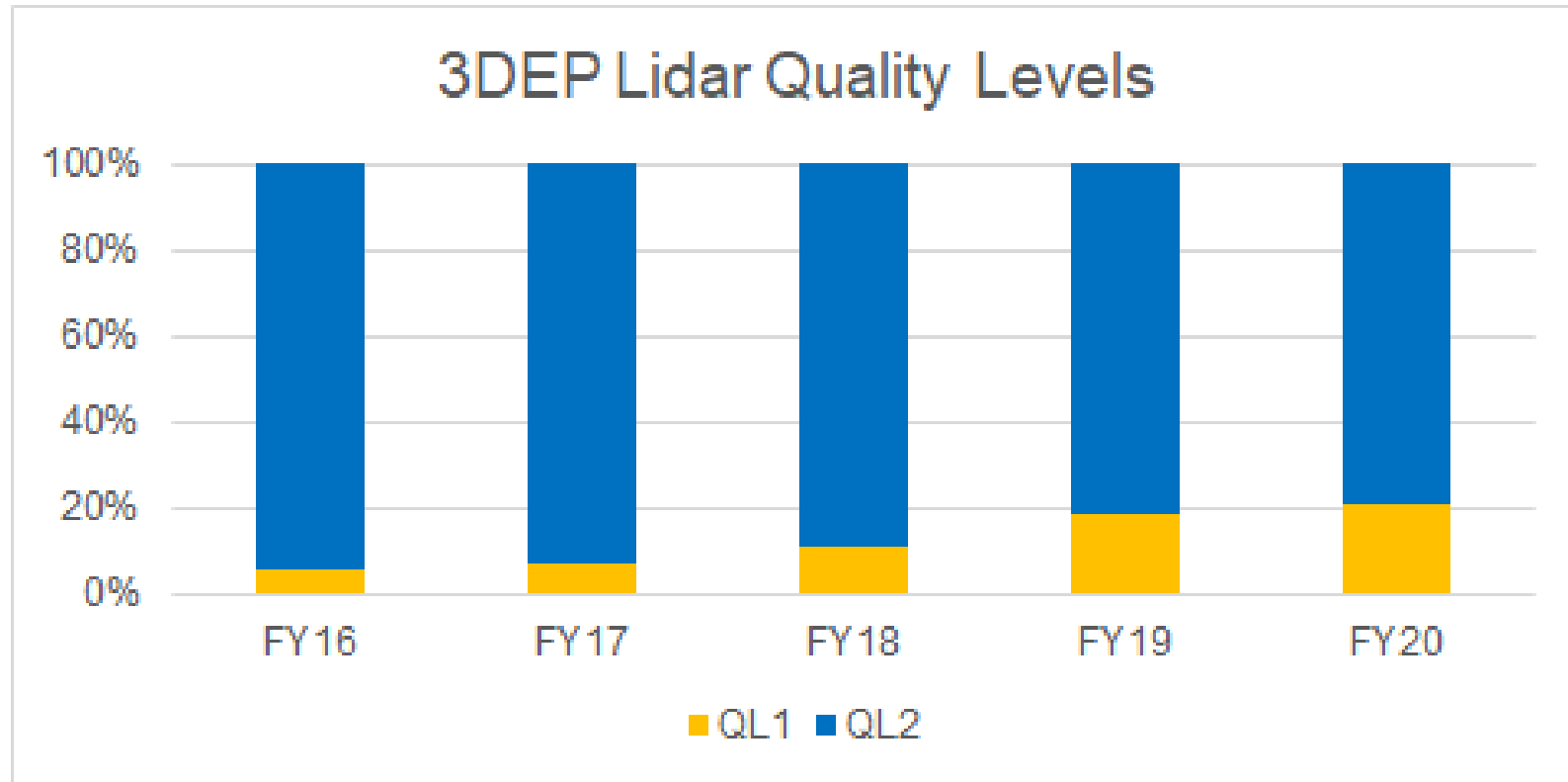
	Area (sq. mi.)	Total project value (\$Million)	Partner funding (\$Million – funding other than USGS/ FEMA/ NRCS)
BAA – 26 projects in 17 states	151,900	\$40.5	\$12.8
Other Partnerships (Federal, non-federal, and contributed data)	298,500	\$68.3	\$10.6
TOTAL	450,300	\$108.8	\$23.4



Data Trends

Increasing requirements for QL1 data

- FY20 Contracted Sq miles
 - QL1: 21% (86K)
 - QL2: 79% (336K)
- Some state plans now calling for statewide QL1 data
- Also foresee trend toward repeat coverage for areas with older data



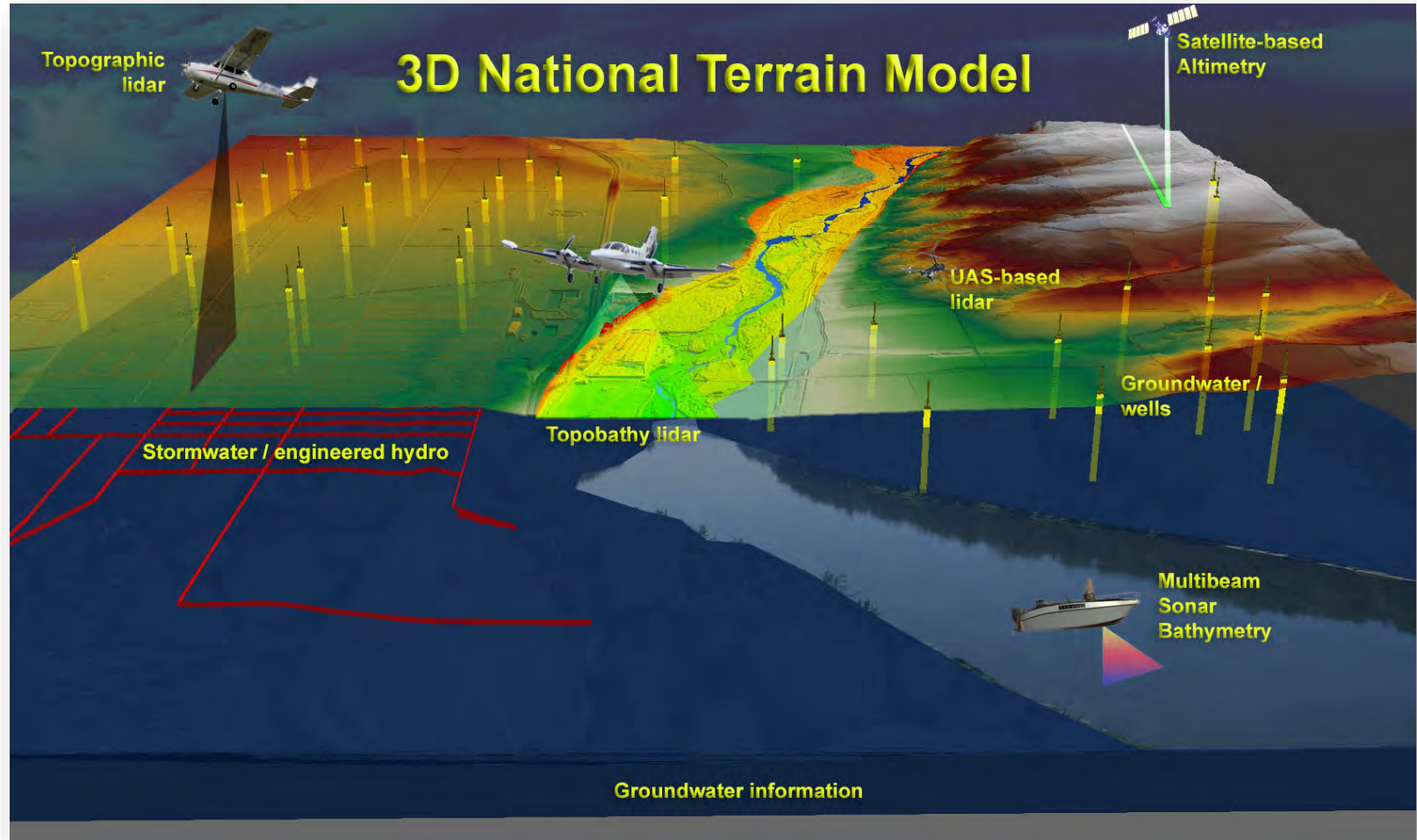
+ The 3D National Terrain Model

Implement the USGS terrestrial component of 3D Nation

A continuous, integrated 3D elevation and hydrography surface

To improve and enable critical applications

- Flood forecasting in 3D, at the street level
- Hydrologic observing systems and models that account for water from the atmosphere to the oceans
- Support Clean Water Act reporting
- 3D Geologic models
- New and unimagined 3D applications



6 STRATEGIES

The **3D National Terrain Model (3D NTM)** Vision for the Future Generations of USGS Hydrography and Elevation

1 COMPLETE NATIONWIDE BASELINE DATA

- Unifies observations and measurements onto one multiscale hydrography framework
- Realizes the benefits and ROI of nationwide lidar

3DEP & NHDPlus HR

2



ESTABLISH THE NATIONAL HYDROGRAPHY INFRASTRUCTURE

Implement the NHI as the authoritative, universal source for sharing and discovering water information

3

3DEP & 3D NHD

INTEGRATE HYDROGRAPHY AND ELEVATION

Derive hydrography with Z-values from lidar to move from the neighborhood to the street-level in accuracy of features

4 INTEGRATE GROUNDWATER AND ENGINEERED HYDROLOGIC SYSTEMS

4

Integrate connection points to groundwater and engineered hydrologic systems to allow better accounting of the hydrologic cycle



5

3D National Terrain Model

INTEGRATE INLAND BATHYMETRY

- Extend elevation surface under water bodies
- Replace estimated flow volume with volume calculated from the mapped surface

6

4D National Terrain Model

REPEAT COVERAGE

- Enable monitoring and change detection
- Analytical capabilities increase exponentially with the availability of multiple data vintages

Enables 3D topographic maps and links with 3D geologic models to visualize data in new and unimagined ways



Supports the National Water Model, National Water Census, drought, water availability and use



Supports the 3D National vision of elevation data from the depths of the oceans to the peaks of the mountains



Provides a mapping foundation for the Clean Water Act





Inland Bathymetry

- Commercial bathymetric lidar sensors are available for mapping both coastal and inland bathymetry
- Collections will help inform future specifications and topo-bathy lidar collection criteria
- First 3DEP pilot project to assess commercial capabilities in FY17: Kootenai River in Idaho
- Bathymetric lidar survey completed on the Klamath River in CA in 2018, survey of the Potomac River (MD/WV) in 2019, and Niobrara River (NE) survey planned for 2020
- USGS scientists collected field data during lidar surveys for assessing instrument performance and data quality

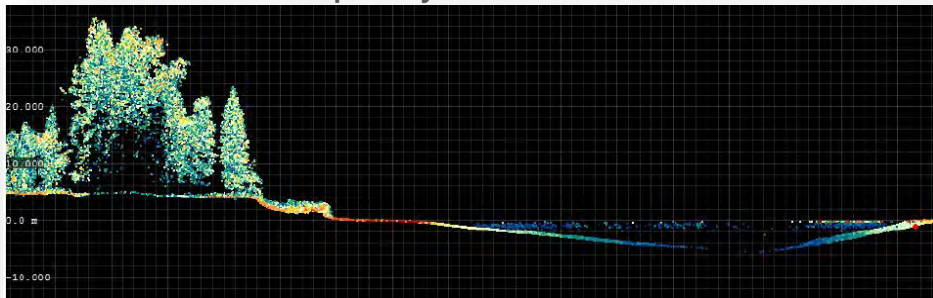
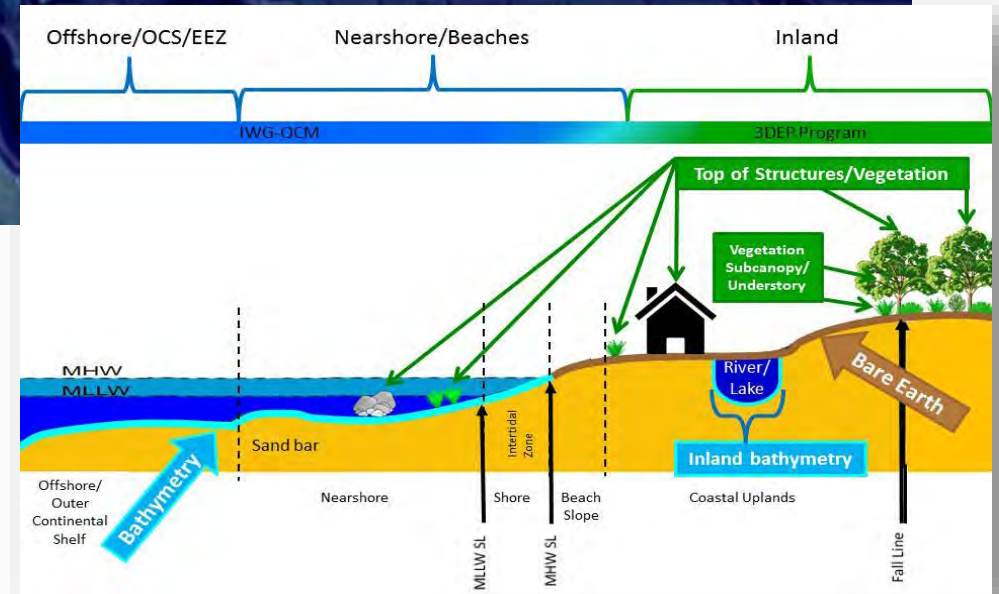


Image courtesy of Quantum Spatial International



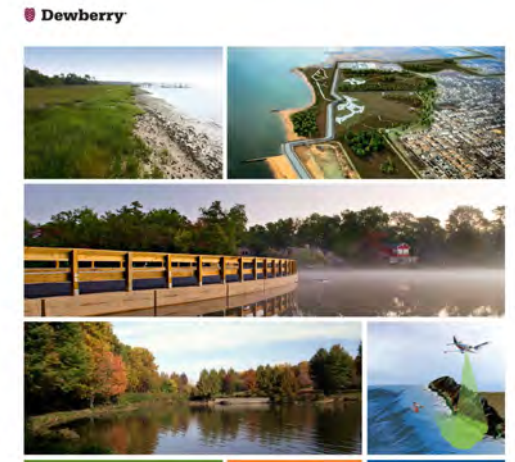
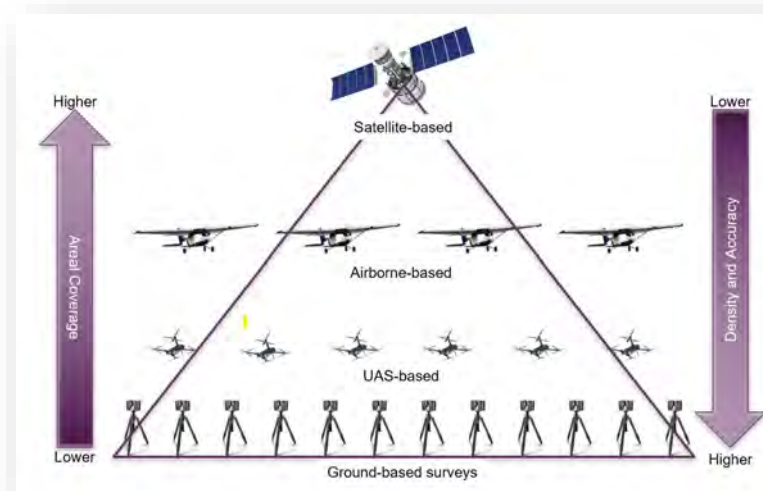
4D
National
Terrain
Model

6 REPEAT COVERAGE



- 3D Nation Elevation Requirements and Benefits Study
 - Working with NOAA to understand inland, nearshore and offshore bathymetric data requirements and benefits
 - Gather technology-agnostic user information to be able to assess new technologies against requirements and identify the tradeoffs between different approaches
 - **Plan for the next generation of 3DEP - Results will lead to a completely new approach regarding QLs, refresh frequency by geography, products offered, and other changes**

- Hydrography Requirements and Benefits Study
 - Use results to help define the optimal refresh cycle and new data accuracies and qualities



National Hydrography Requirements and Benefits Study

Preliminary Results
May 20, 2016

SPONSORED BY
Dewberry
1845 Kings Highway
Foster, Virginia 22031-8655

PREPARED BY
U.S. Geological Survey
1225 Summer Valley Drive
Reston, VA 20192

3D
National
Terrain
Model

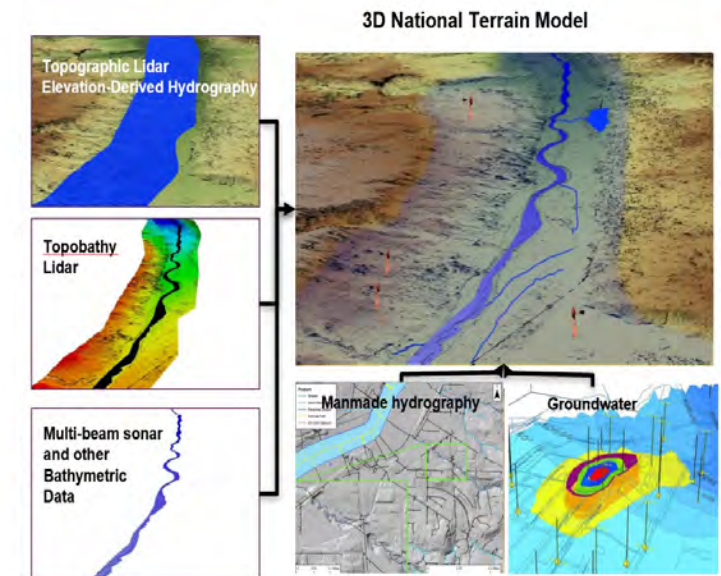
NEXT STEPS

Developing 3DNTM Call for Action in 2 Parts

- On a high-level, define the program including roles, partnerships, governance, funding, products and services, research and more
- Part 1 - Overview of 3DNTM and deeper dive on hydrography
 - Mine the Hydrography Requirements and Benefits Study and focus on plans for deriving hydrography from elevation, NHI, groundwater and engineered hydrologic system to propose program scenarios
 - Timeframe – target to have draft by spring
- Part 2 – Further refinement of 3DNTM and deeper dive on elevation
 - Using the results of the 3D Nation Requirements and Benefits study, 3DEP technology study by Aerospace, and other information, propose new program scenarios for the next generation of 3DEP, including inland bathymetry
 - Timeframe – target to complete by end of FY21



The 3D National Terrain Model – A Call for Action



Circular XX

U.S. Department of the Interior
U.S. Geological Survey



Strategies to Complete the National 3DEP Baseline

Continue to leverage key applications

- About \$1.7M annually from EarthMRI for lidar acquisition in last few years
- FY19 funds leveraged in BAA
- FY20 partnership with USGS Earth MRI and DOE to acquire data in Nevada and other areas lacking coverage

Nevada/California GeoDAWN project:

- 36,500 square miles of lidar data
- \$7.5M in funding from USGS, NRCS, DOE, BLM, and FEMA R9



GeoDAWN

Geoscience Data Acquisition for Western Nevada

The USGS Earth Mapping Resources Initiative and USGS 3D Elevation Program (3DEP), Department of Energy Geothermal Technologies Office, Natural Resources Conservation Services, and Bureau of Land Management have partnered to conduct airborne geophysical and 3DEP lidar surveys over parts of Nevada and California to collect information on undiscovered geothermal, critical mineral, and groundwater resources in the western Great Basin and the Walker Lane region.

Geothermal Resources

Recent discoveries have indicated significant potential for geothermal resources in western Nevada, which is already the second-largest producer of geothermal energy in the Nation. This survey will collect information that will highlight which areas to focus on next.

Critical Minerals

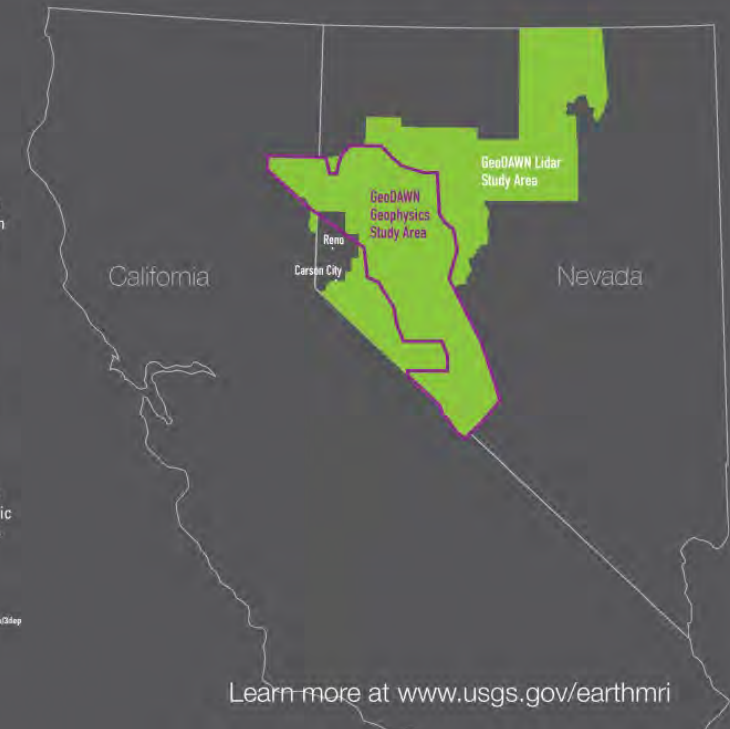
The western Great Basin is home to many mineral resources that have been deemed critical by the Department of the Interior, particularly lithium. Lithium is an important commodity for batteries and modern electronics. The study area will focus on lithium- and boron-bearing clays, sediments, and brines.

Groundwater & Agriculture

The airborne geophysical and 3DEP lidar data will reveal more than just energy and mineral resources. The aeromagnetic data will shed light on groundwater potential, while the new lidar and radiometric data will allow for detailed mapping of soils critical for agriculture.

Geohazards

The Walker Lane region of western Nevada and adjacent areas in California contain several areas that could trigger seismic activity. The new topographic and geophysical data should help identify the faults in the region and enable scientists to learn more about the potential for seismic hazards.



*Project Status: In progress as of September, 2020.

Sources: 1 <https://geoddb.usgs.gov/emi/> 2 <https://www.usgs.gov/special-topic/earthmri> 3 <https://www.usgs.gov/core-science-systems/nep/3dep>

U.S. Department of the Interior
U.S. Geological Survey

Learn more at www.usgs.gov/earthmri



Strategies to Complete the National 3DEP Baseline

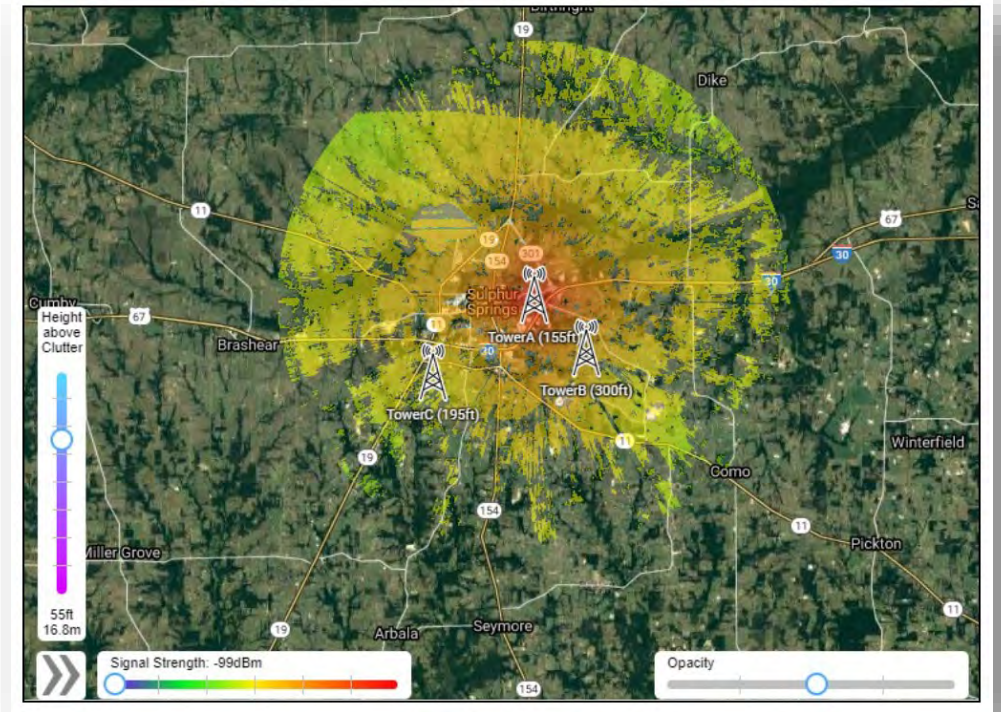
Continue to leverage key applications

Broadband Development as a critical new application

FCC section of the 2021 House Appropriations Subcommittee on Financial Services and General Government -- Committee Report (p. 59):

Elevation Data Coordination for Broadband Deployment.—The U.S. Geological Survey is leading the 3D Elevation Program (3DEP), a collaborative initiative to systematically collect accurate enhanced elevation data nationwide primarily through Light Detection and Ranging (LiDAR) technology. Such data can facilitate line-of-sight analyses for signal propagation studies, identification of the optimum locations for cell tower networks and other broadband deployments, models of potential impacts to wireless signals from future development and vegetation growth, mapping of existing towers, and design and permitting of new infrastructure. The Committee encourages the FCC to participate in this program to help support the deployment of 5G and other next-generation wireless services.

The Committee understands that FCC participation in 3DEP will strengthen the Commission's support for building, maintaining, and expanding U.S. wireless networks.



A model of broadband signal developed by Cambium Networks. The model uses 3D information on obstructions such as trees and buildings, combined with signal strength and tower height to predict broadband coverage. Figure courtesy of Cambium Networks.

THANK YOU!

