KEYNOTE

Geospatial: A National Perspective

Presented by:
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AGENDA

1. Big Program Updates
2. Sensors – The Latest Technology
3. Big Data
4. Shifting Data to the Cloud
5. Deep Learning
Big Program Updates
3DEP

• Nearly 65% complete for the nation
• Due to ODNR and other state agencies, Ohio is getting new QL1 lidar data
• As 3DEP nears completion, USGS is looking to create an enhanced hydro layer (some counties in OH and the region will be early adopters of this new hydro spec)

2022 and Beyond

• USGS will go into maintenance mode for lidar
• Other derivative products from the data will be created
Mission

• JALBTCX is an intra-governmental partnership in airborne lidar bathymetry and complementary technologies among the U.S. Army Corps of Engineers, Naval Oceanographic Office, National Oceanic and Atmospheric Administration, and U.S. Geological Survey.
National States Geographic Information Council (NSGIC)

Taking a leadership role in assisting states with their plans and partnership with USGS for 3DEP and statewide lidar plans

NSGIC continues to champion:
- National address database
- Broadband development
- Cloud computing
In 1994, Executive Order 12906 and OMB guidance assigned FGDC to develop the National Spatial Data Infrastructure (NSDI) and established a National Spatial Data Clearinghouse to track and coordinate geospatial data investments.

**NSDI LAYERS**

- Transportation
- Hydrography
- *Elevation
- Cadastral
- Political Boundaries
- Geodetic Control
- *Ortho Imagery
Geospatial Data Act (GDA)

Geospatial Data Act of 2018:

• Became a law on October 5, 2018 and was included as a component of the FAA Reauthorization Act

• Codifies the committees, processes and tools used to develop, drive and manage the National Spatial Data Infrastructure (NSDI) and recognizes responsibilities beyond the Federal government for its development

• Reflects growing recognition of the essential role of geospatial data and technology in understanding and managing our world

• Highlights the need to support continuing development as critical investments for the Nation
Reporting and Oversight

• Covered agencies must prepare, maintain, publish and implement a strategy for advancing geographic information and related geospatial data and activities appropriate to the mission of the covered agency, in support of the strategic plan for the NSDI.

• Each covered agency will submit an annual report to the FGDC regarding the achievements.

• At least once every two years, the inspector general of a covered agency (or senior ethics official for a covered agency without an inspector general) shall submit to Congress an audit of the collection, production, acquisition, maintenance, distribution, use, and preservation of geospatial data.
National Oceanic and Atmospheric Administration (NOAA)

• 2020 marks **50 years** of science, service and stewardship for NOAA
• Partnering with USGS on the 3D Nation study to replace NEEA
• National Geodetic Survey (NGS)

  • By 2022, reduce all definitional & access-related errors in geometric reference frame to 1 cm when using 15 min of GNSS data **“Replace NAD83”**
    (NAD83 = North American Datum 1983)
  • By 2022, reduce all definitional & access-related errors in orthometric heights in geopotential reference frame to 2 cm when using 15 min of GNSS data **“Replace NAVD88”**
    (NAVD88 = North American Vertical Datum 1988)
Sensors –
The Latest Technology
The RIEGL VQ-880-G is a fully integrated airborne laser scanning system for combined hydrographic and topographic surveying.
Coastal Zone Mapping and Imaging Lidar
Leica HawkEye 4X Deep Channel Bathymetric Lidar Sensors
Offshore Mapping with Bathymetric Lidar
UAS-based Lidar

Points Density: 600-900 pts/m²
Accuracy: 2 cm
Altitude: 70 to 300’ AMT
Stationary or Mobile Lidar Systems

Image courtesy: Teledyne OpTech
Terrestrial Lidar

- Mapping the existing condition of a surface, structure, object or feature
- 50,000-1M Points per Second
- Color camera – 700 megapixels for panoramic image
- Colorized point clouds
- Relative Accuracy ~4mm@<50meters
- Absolute Accuracy ~6mm@<50meters
Interior/Exterior Scanning, Mapping and Modeling

3D Lidar Scan Station

Scan to BIM

- Advanced Reality Capture methods
- Advanced modeling methods

Top Left: Fort Campbell, Top Right: SFO Interior, Bottom Left: MARTA, Bottom Right: SFO Exterior
Leica CityMapper-2

- New design with major improvements
- Internal storage reduces cabling
- Storage improved to 15,360 Tb
- New control panel, key and stop system
- New bar handles reduces size and gives possibility for placement on handles for any lens and camera service
New nadir & oblique sensor system

- 20,544 x 14,016 PAN
- 288 MP nadir (PAN/RGB/NIR)
- 150 MP oblique (RGB)
- 1 frame per 0.7 seconds
- Adaptive Motion Compensation
Oblique Lidar Scanning

Frankfurt, Germany elevation and intensity data
New Generation of Digital Cameras bring Giant Capabilities

5-cm (2") GSD from 1,180 meter (3,870 ft.)**

** DMC III specifications
Woolpert’s Current UAS Fleet

- SwellPro Splash Drone
- senseFly albris
- DJI Inspire
- senseFly eBee X RTK

UAS altitude is limited to 400ft AGL by the FAA. In restricted airspace, altitude ceiling may be lower.
Thermal Underground Utility Detection/Evaluation

- Roofs inspection
- Fluid Leaks
- Energy Loss (steam pipes, hot water pipes)
Monitoring and Evaluation of Water Resources

- Wetlands Detection
- Mapping Water Courses
Uses for Aerial Thermal Imagery for Environmental Management

Lake Morphology:
- Subsurface Investigation
- Pollution
Heat Score Map for Monitoring Building Heat Efficiency
Big Data
Advanced Sensor Technologies result in piles of big data.

Land-based, aerial and space-based sensors dump tremendous amounts of data.

Expanded cadence in data acquisition contributes to the increase in data volume.
Sensors and Data Generation
Data Sizes for a County Size of 400 sq. mi.

**Lidar QL2**
217 GB (2,071,990,488 pts)

**Lidar QL1**
714 GB (8,287,961,952 pts)

**Lidar SPL/GML**
2.6 TB (33,151,847,808 pts)

**Imagery 15cm GSD**
1.7 TB (743,321,199,600 pixels)
Shifting Data to the Cloud
Sample Cloud Journey

- **Decide**
  - Business case
  - Technical case
  - Decision to move

- **Assess**
  - Awareness
  - Experimentation
  - Feasibility

- **Plan**
  - Foundational knowledge
  - Solution Design
  - Planning

- **Deploy**
  - Implement
  - Migrate and integrate
  - Expand

- **Optimize**
  - Ops
  - Review
  - Iterative enhancement
“X as a Service” means paying for the service you want
• With the ability to cancel the service when you don’t need it

Everyday Example: Lyft is a Ride as a Service
• You get driven to the destination you want
• Without having to own the car

Geospatial analysis is like Lyft
• You need the answers so you can make decisions
• The data is NOT the answer. It’s the ‘thing’ you need to derive the answer
• Consider ‘renting’ the data as a subscription
Deep Learning
Deep Learning

What is Deep Learning?

Deep learning structures algorithms in layers to create an “artificial neural network” that can learn and make intelligent decisions on its own.
Deep Learning vs Machine Learning

**Machine Learning**
- **Input**
- **Feature extraction**
- **Classification**
- **Output**
  - Car
  - Not Car

**Deep Learning**
- **Input**
- **Feature extraction + Classification**
- **Output**
  - Car
  - Not Car
Benefits of Deep Learning


✓ Provides opportunity for increased workload & efficiency *when fully cloud scaled* (processing multiple datasets, projects)

✓ Repeatable, Self-Improving System
## Capabilities: Feature Extraction “Plus”

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A Typical Deep Learning Journey
THANK YOU

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