Drones – How Can They Help My County?

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HOUSTON ENGINEERING INC.

Reaching New Heights

34th Annual North Central Local Roads Conference

Rapid City, SD - October 16-17, 2019

“Basic” Drone Technology

Drone Technology

HEI Drone Program

- **12 pilots** who are certified to fly drones across the Upper Midwest
- Trained surveyors and technical professionals – boots on the ground
- Front edge of the technological world – software to drones

Drone Technology

WHAT DATA CAN A DRONE CAPTURE?

High Quality Photos

4K Resolution Video

Volume of Material

Existing Topography for Digital Elevation Models
(accuracy will depend on project)

Minnesota County Survey of Materials

Client Benefits

- County can now measure fill at any time of the year instead of waiting for winter
- Surveyors no longer have to climb a potentially dangerous mound
- Provided a 3D surface and fill report to the County

Drone Technology

Video/Photo Based Inspections

Cover miles of pipelines, roads, ditches, etc. in a fraction of the time and cost. Plus, you'll have 4k video and high-resolution images to reference again and again.

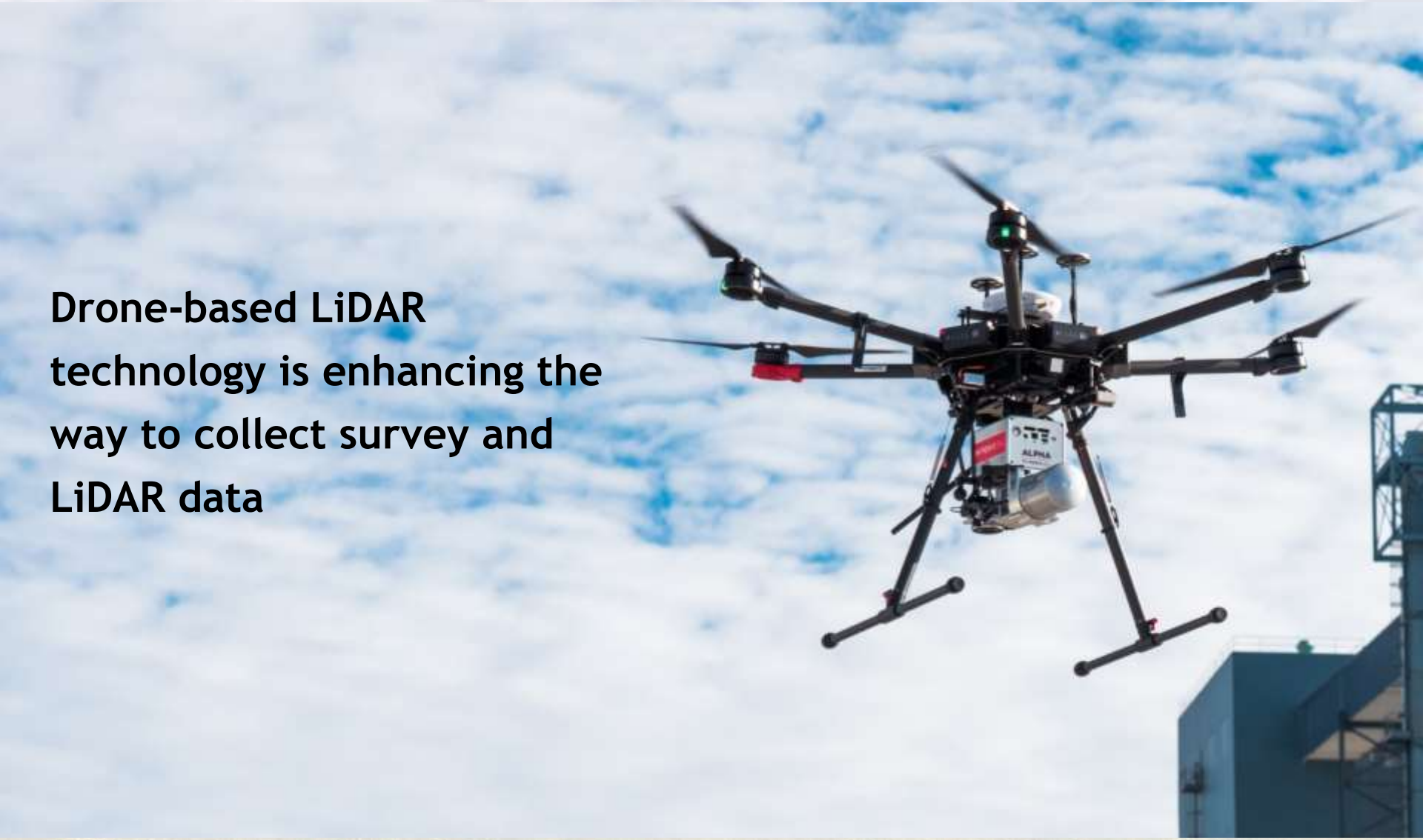
Drone Technology

The City of Lake Park in Minnesota enlisted HEI to capture drone footage of their bridge construction progress to share with the public through Facebook.

Drone-Based LiDAR (DBL)

Drone-Based LiDAR

Drone-based LiDAR technology is enhancing the way to collect survey and LiDAR data



Drone-Based LiDAR

State-of-the-art drone LiDAR system and analysis software provide cost effective and accurate survey packages to clients

Real-Time Streaming Data: Identify Problem Areas Early

Goals of DBL

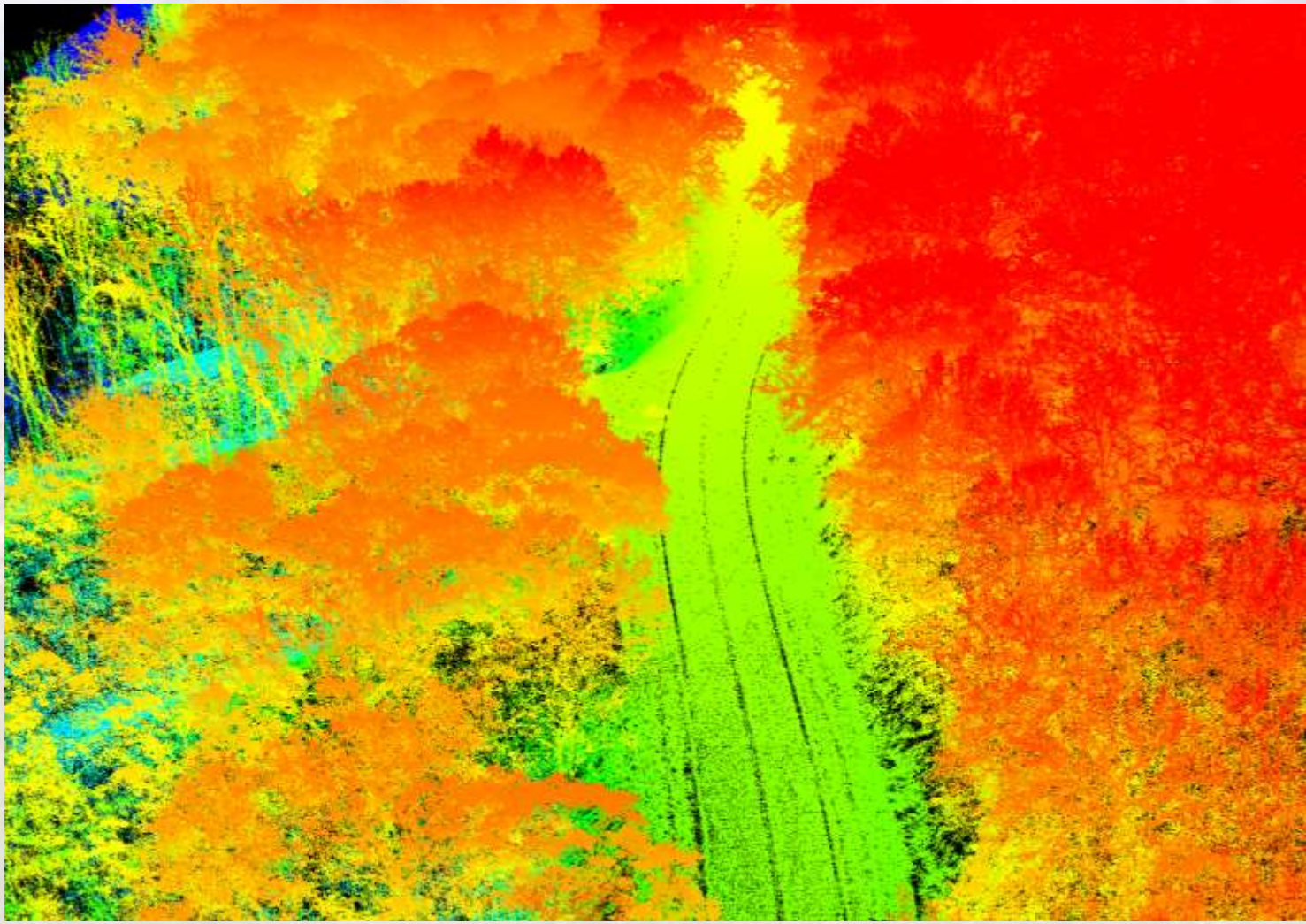
- GPS level accuracies of the point cloud
- One data collect for the entire project
- 1,000+ feet of corridor width
  - ROW Issues?
- Point cloud density at or above 30 points per foot
- Keep surveyors off roadways as much as possible

Example Highway Projects

- Extremely difficult survey 1:1 slopes and dense vegetation
- LiDAR could accurately survey through the trees and slopes
- Penetrated dense tree cover and vegetation
- Onsite about 6 hours
- Surveyed 3 sites
- Total 10 miles

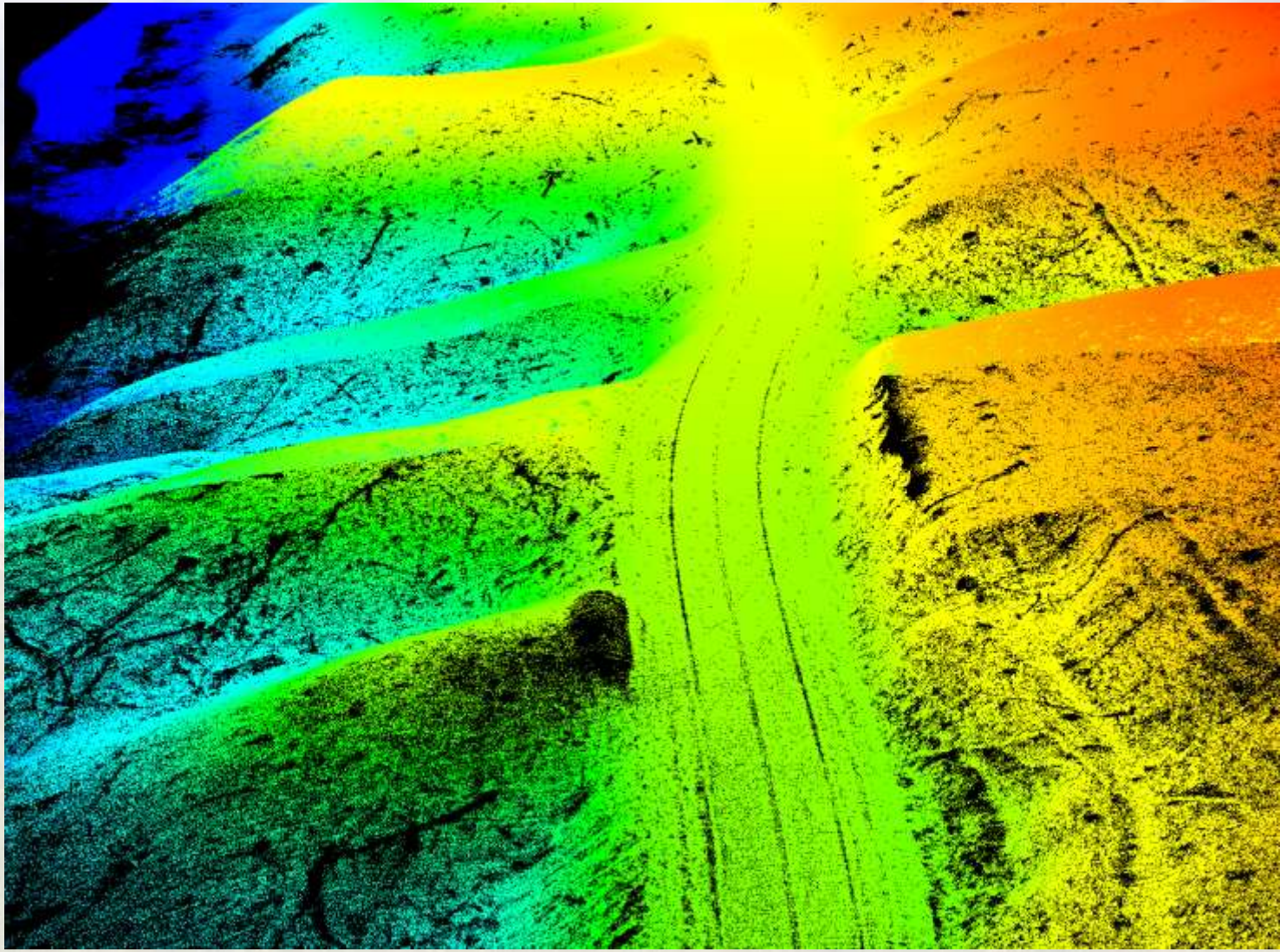
Too Much Data?

- Full LiDAR collection
- Video of area fly through



Nope!

- Ground classification only



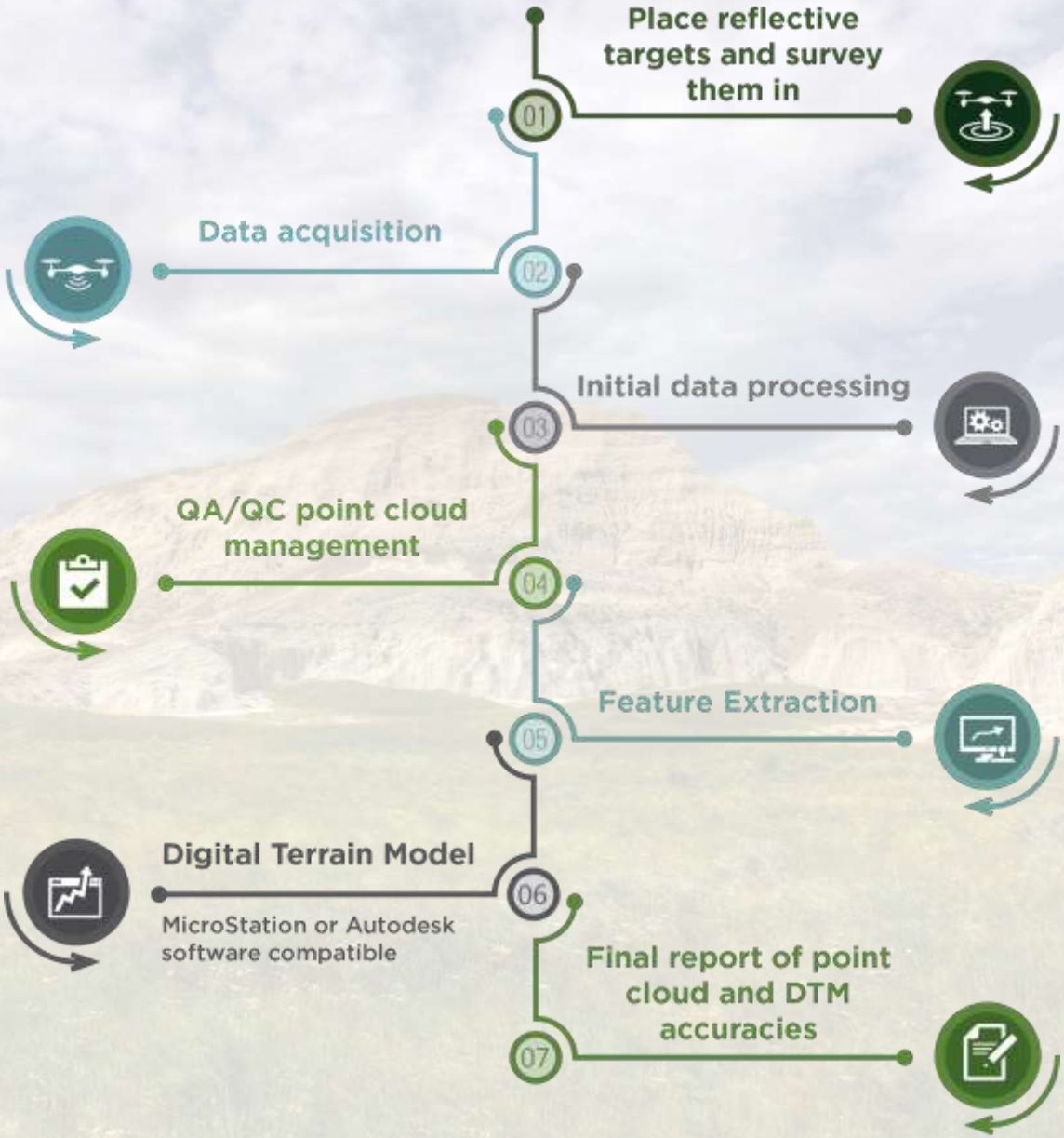
Not Your Ordinary Drone

- ALTUS Intelligence Orc 2
- MFD 5000 (Watts Innovations Custom Drone)
- <55 lbs. TOTAL

Top of the Line Sensors

Riegl VUX 1 Ranger UAV	Riegl VUX 1 Ranger LR
200m max AGL	530m max AGL
+/- 1-2 cm Accuracy	+/- 1-2 cm Accuracy
550k points/sec, 7 returns	700k points/sec, 7 returns
EO Camera	EO Camera

Typical Workflow on a Project



Drone-Based LiDAR Survey Process

Survey Tasks

Platform Determination

- Is the project best suited to drone-based LiDAR or mobile LiDAR?
- Same LiDAR sensor used for both platforms

Project Control

- Establishment of Control Network
- LiDAR Control Targets

Survey Tasks

Supplemental Survey Tasks

- Ground Truthing
- ”Void” Areas

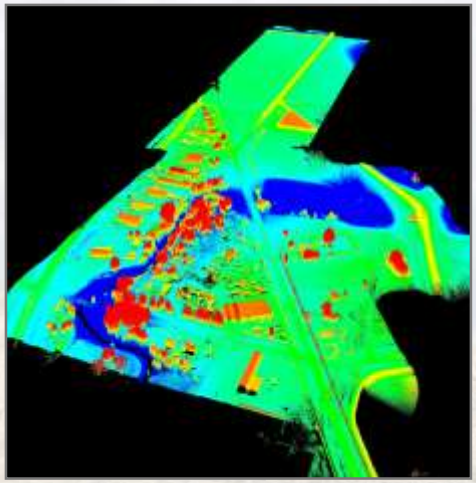
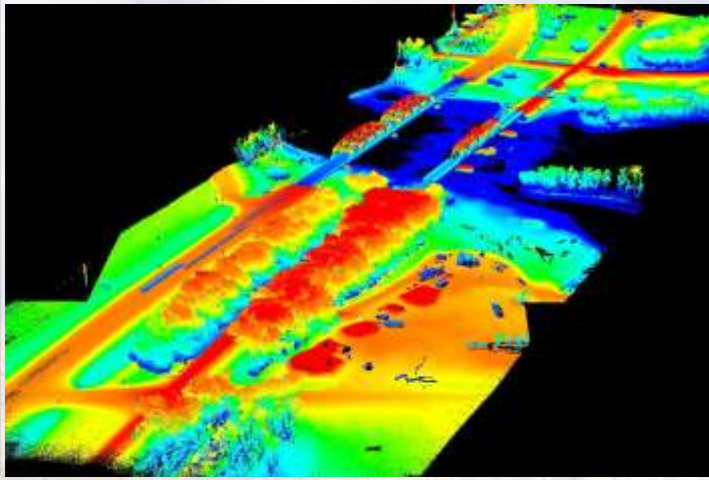
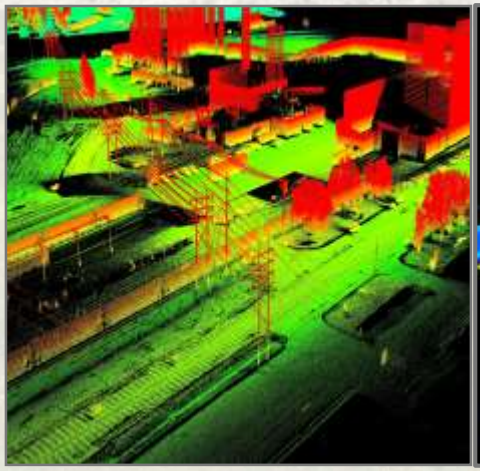
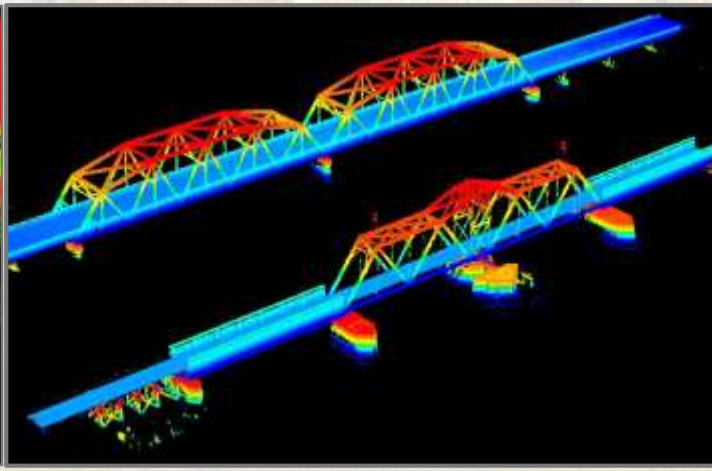
PLSS, Alignment, and Right-of-Way

Turning Drone-Based LiDAR into a Deliverable

Drone-Based LiDAR: Benefits vs. Traditional Survey Methods

Quality and Accuracy

- Drone-based LiDAR allows us to capture millions of data points with survey-grade vertical accuracy
- More data points = highly accurate surface models for design deliverables
- Need experts in data processing

Process from Collection to Deliverable

Feature Extraction

- Topographic
- Spot elevation
- Void/obscured areas

Generate Existing Ground Surface

- MicroStation
  - InRoads
  - GeoPak
- AutoCAD
- Other design platforms

What We've Learned

sensor upgrade

ND 3 - 18 miles flat/rolling terrain

- Point density is key
- Mowing
- Void identification

sensor upgrade

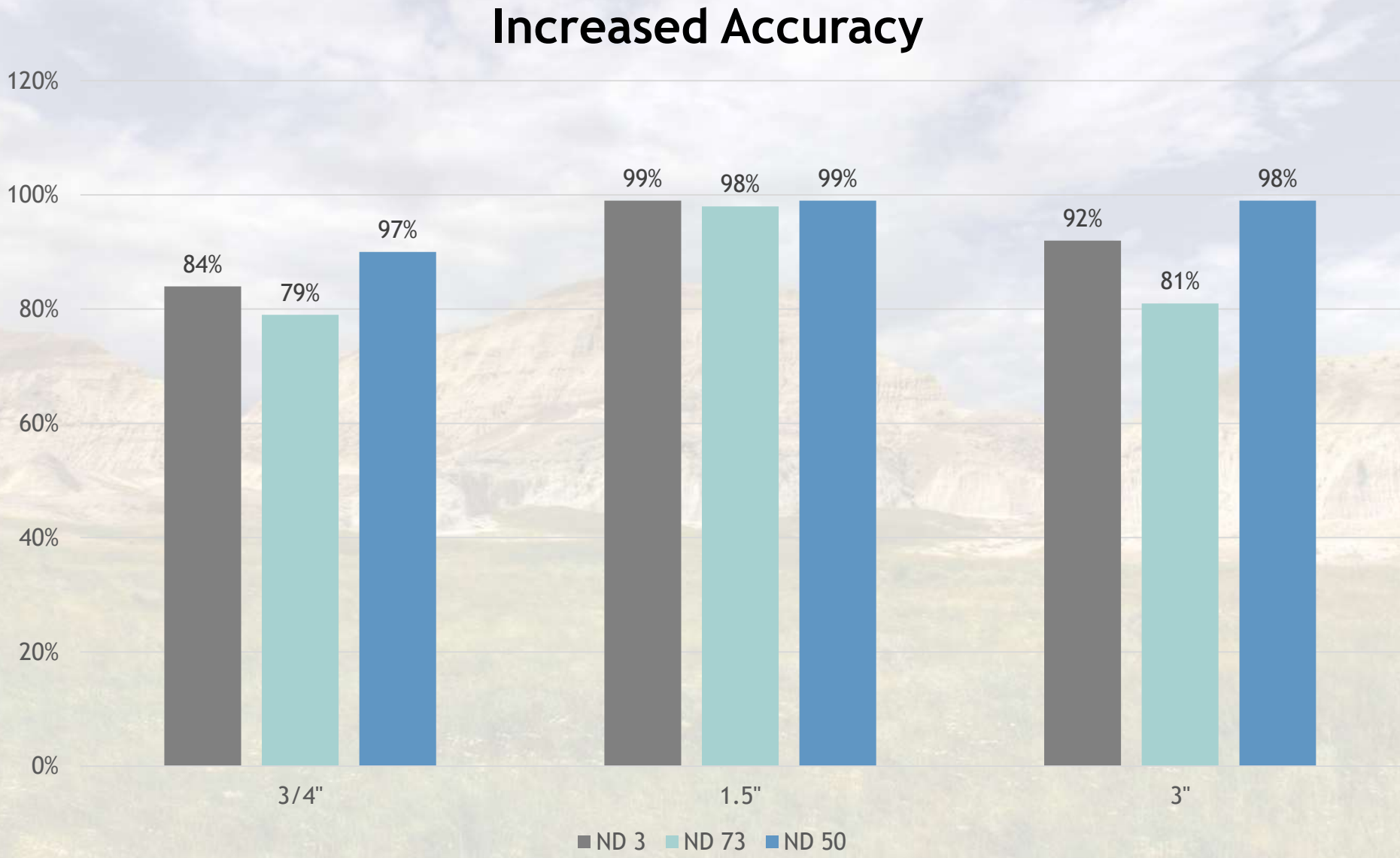
ND 73 - 11.5 miles rough terrain

- Doubled point density
- Processing techniques to maximize accuracy while minimizing file size of the final deliverable

ND 50 - 20 miles flat terrain

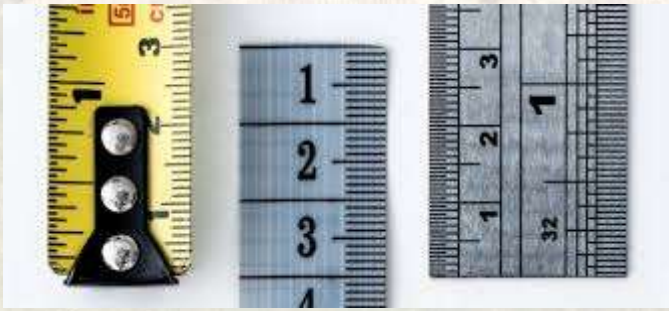
- 10-15 times the point density

What We've Learned



What We've Learned

- But what does that really mean?
  - Average difference between control and final surface ~
    - On the road: 0.02' or ¼"
    - Off the road: 0.08' or 1"



Drone-Based LiDAR: Benefits vs. Traditional Survey Methods

Flexibility and Time Savings

- Drone-based LiDAR flights can be **done within hours vs. several days or weeks** compared to traditional survey methods
- Weather and cloud coverage are no obstacles when scheduling flights since drones can fly at lower levels and at night
- Drone flights **require less manpower** than a typical survey crew, thus can mobilize quickly to reach job sites
- It eliminates the scheduling hassles of a plane for aerial LiDAR

Drone-Based LiDAR: Benefits vs. Traditional Survey Methods

Safety

- Drones can be flown over rough, unstable terrain or unreachable areas

- Team uses trained pilots (not just drone, actual pilots) and survey professionals. We understand the complex FAA relationships to ensure we're flying in compliance and always with safety in mind

- Drones can fly at **NIGHT** for busy roadways or complex urban projects to lessen impacts to traffic

Drones can capture data in places where it can be a safety risk for people

Drone-Based LiDAR: Benefits vs. Traditional Survey Methods

Cost

- Traditional surveys - hours vs. days for actual survey
- Drone-based LiDAR - higher processing costs

Rough Cost Savings

- 20% less expensive than Stereo Compilation
- 30%-50% less expensive than traditional survey methods

HEI's Capabilities

Established in 1968

220+ employees

Focus on Emerging Technologies

- GIS
- Website and computer programming
- Software development and sales
- Drones and survey technology
- Etc.

Core Service Areas

- Transportation
- Survey
- Environmental
- Water Resources
- Municipal
- GIS/Web Apps
- Land/Site Development
- Planning/Landscape Architecture
- Waste Management

More Information/Resources

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Drone-Based LiDAR Services and Benefits Video

www.houstoneng.com

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Results

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- One data collect for the entire project
  - Down and back travel off the road
- 1,000+ feet of corridor width
- Point cloud density at or above 30 points per foot