

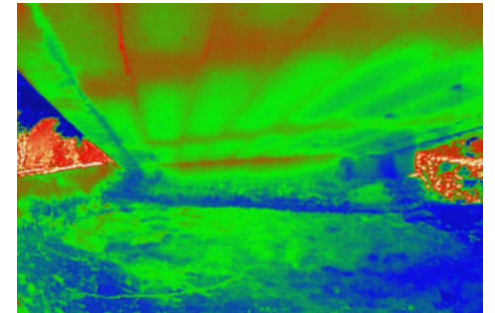
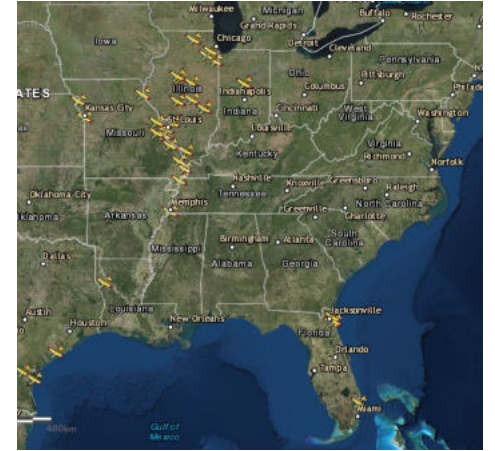
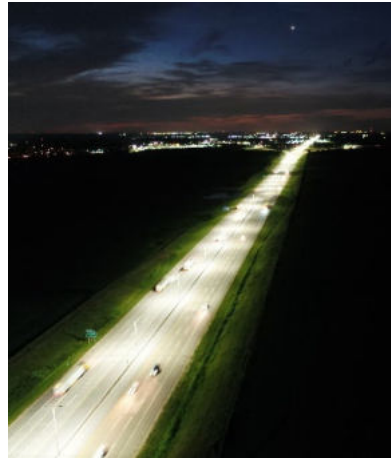
The use of Drones for Bridge Projects

Matt Dondanville - GISP, sUAS Pilot



Hanson's Drone History

- Hanson started using drones in 2014 under section 333 authorizations
- Hanson has 15 pilots who support projects across the United States
- Hanson has completed UAV projects in 13 States

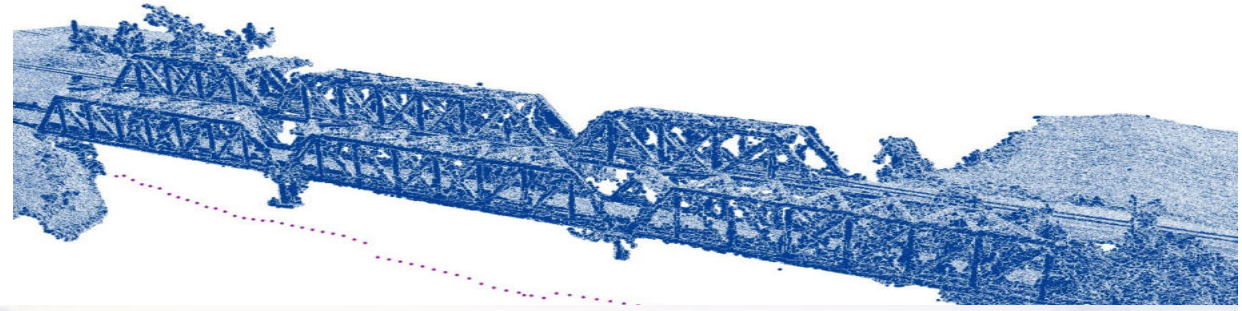


Drones we Own



Drone Rental Partnerships

How we pick our UAV's



- What are we used too
 - Hardware vs. Software
 - Support
 - Ease of Use
 - Reliability
 - Payload Options
 - Time of Flight
- = What's your standard mission?



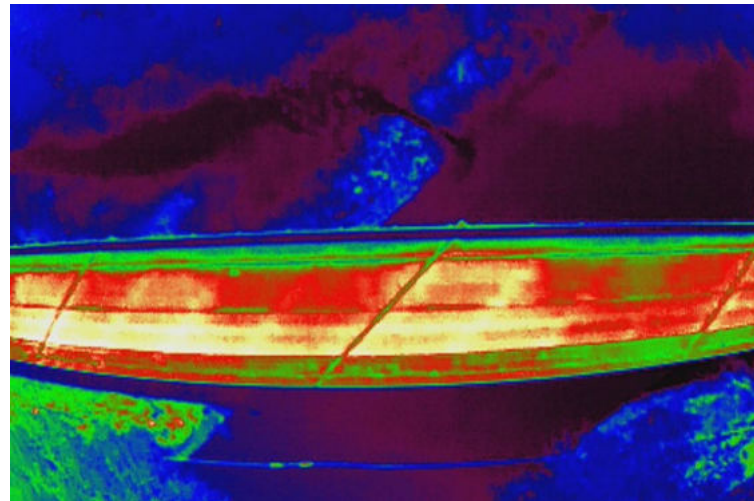
Blended Technology!!!

- Drones / UAV
 - Unmanned Aircraft Systems with multiple camera options using photogrammetry and LiDAR
- Drone Boat – Hydrographic Surveys
- LIDAR and Traditional Survey
- Virtual Reality
 - VR presentations to display proposed alternatives for client's benefit or future bids.











Bridge Inspections

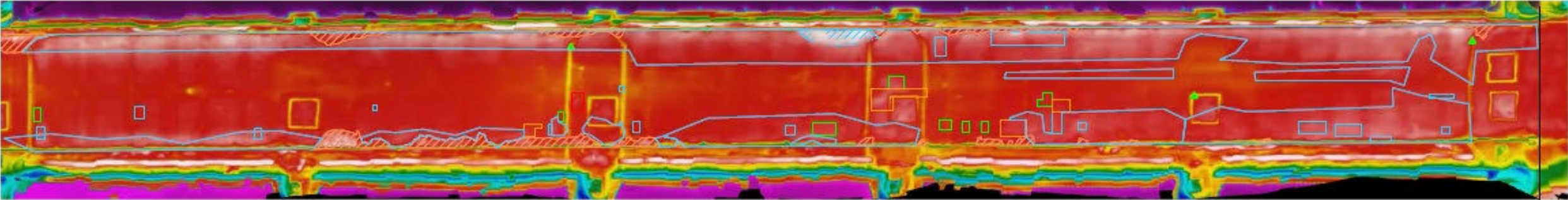
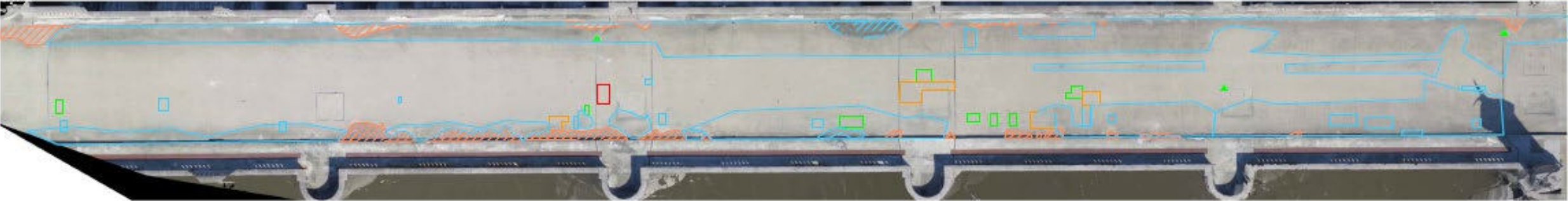
- Deck Assessment
- Paint Assessment
- Culvert / Box Girder Inspection
- Deck Survey w/ Camera
- Hydraulic Survey / Scour
- GPS Free Inspections
 - Indoor



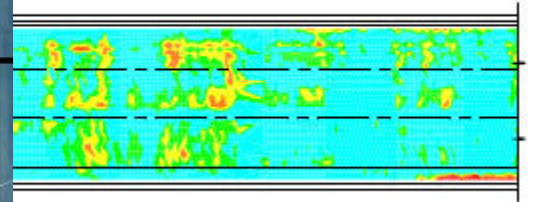
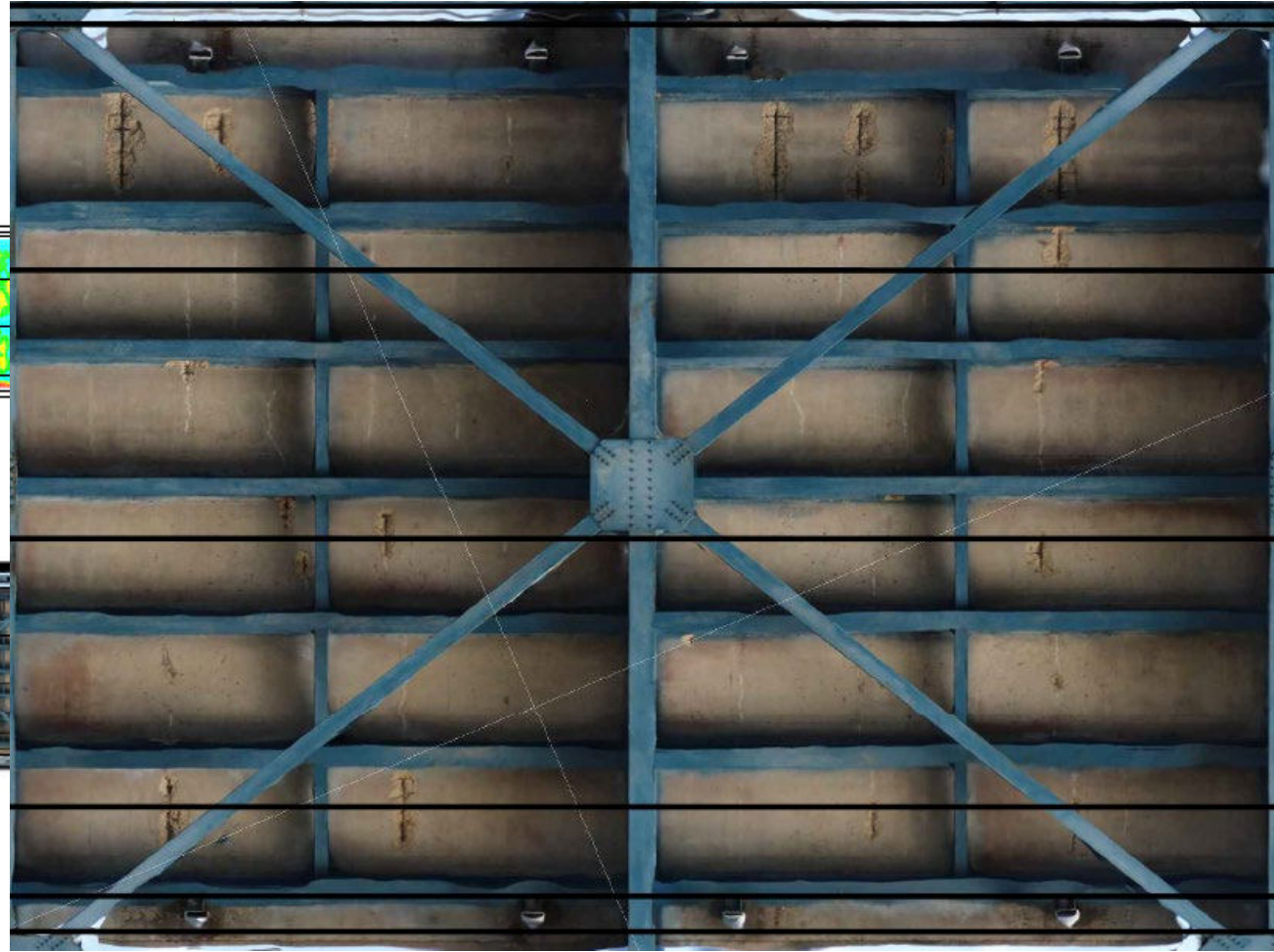
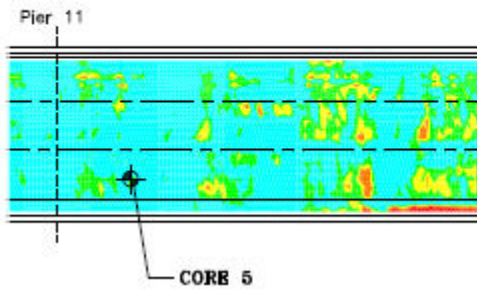
Bridge Inspections

CHAIN DRAG DELAMINATION LOCATIONS LEGEND
(SCALE IS 1-5, WITH 5 THE WORST)

-  LEVEL 1
-  LEVEL 2
-  LEVEL 3
-  LEVEL 4
-  LEVEL 5
-  DEBRIS ON BRIDGE DECK
-  HEAVY STAINING ON BRIDGE DECK
-  LIGHT STAINING ON BRIDGE DECK



McCluggage Bridge



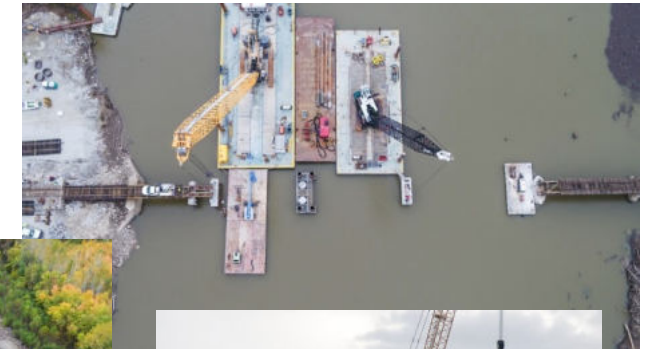
Emergency Drone Response



NS Bridge over the Grand River

Brunswick, MO

- Collapsed October 1, 2019
- Rebuilt in 27 days
- Near Real time drone footage back to NS HQ



NS identifies “second hand spans” around their system



Construction Begins – Oct 3rd



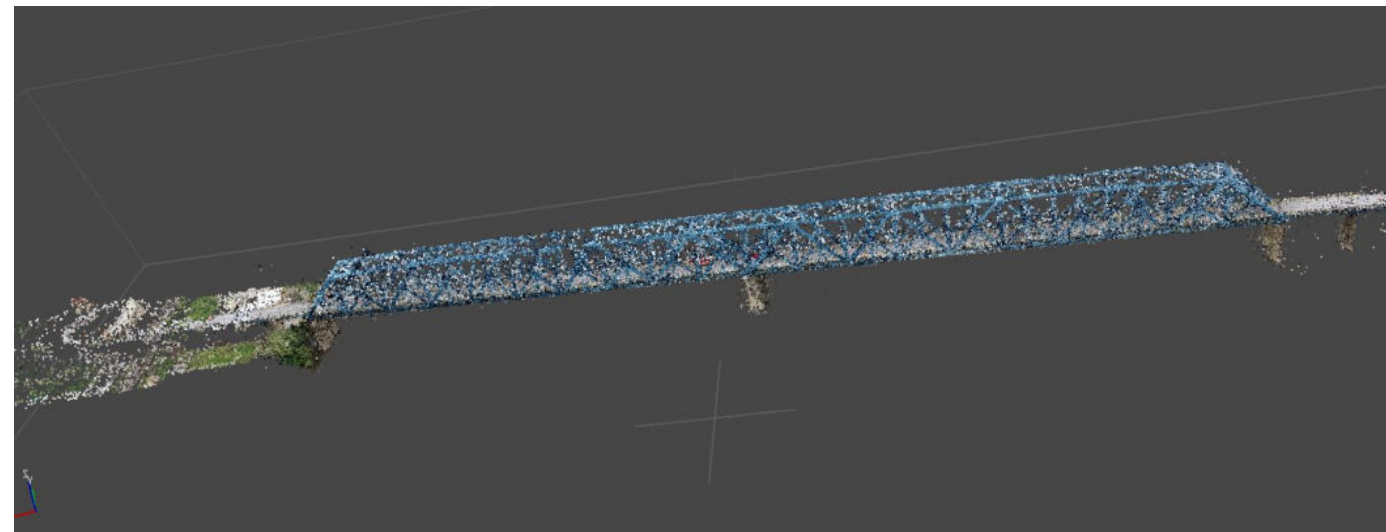
Secondary Bridge Design

- New bridge going through actual design
- Real time engineering on both bridges from drone data
- Data fed to NS and Hanson Engineers in near real time
- Accurate 3D as built of bridge built in 27 days



Structural Gusset Analysis - Quincy

- Lack of Plans
 - Damaged over time
 - Unreadable
- Bridge Open (Safety)
- 6000 Images
- Python Blur Script



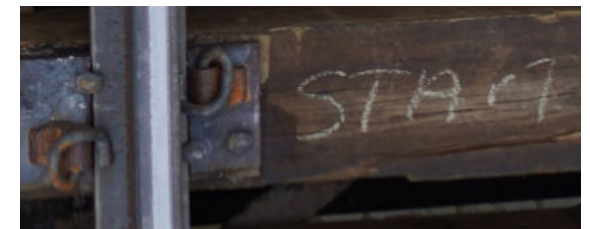
Difficulties in Bridge Modeling

- Water
 - Shades of color
- Shadows
- Proximity to the bridge (Camera Dependent)
- Camera Overlap
- Getting Every Angle



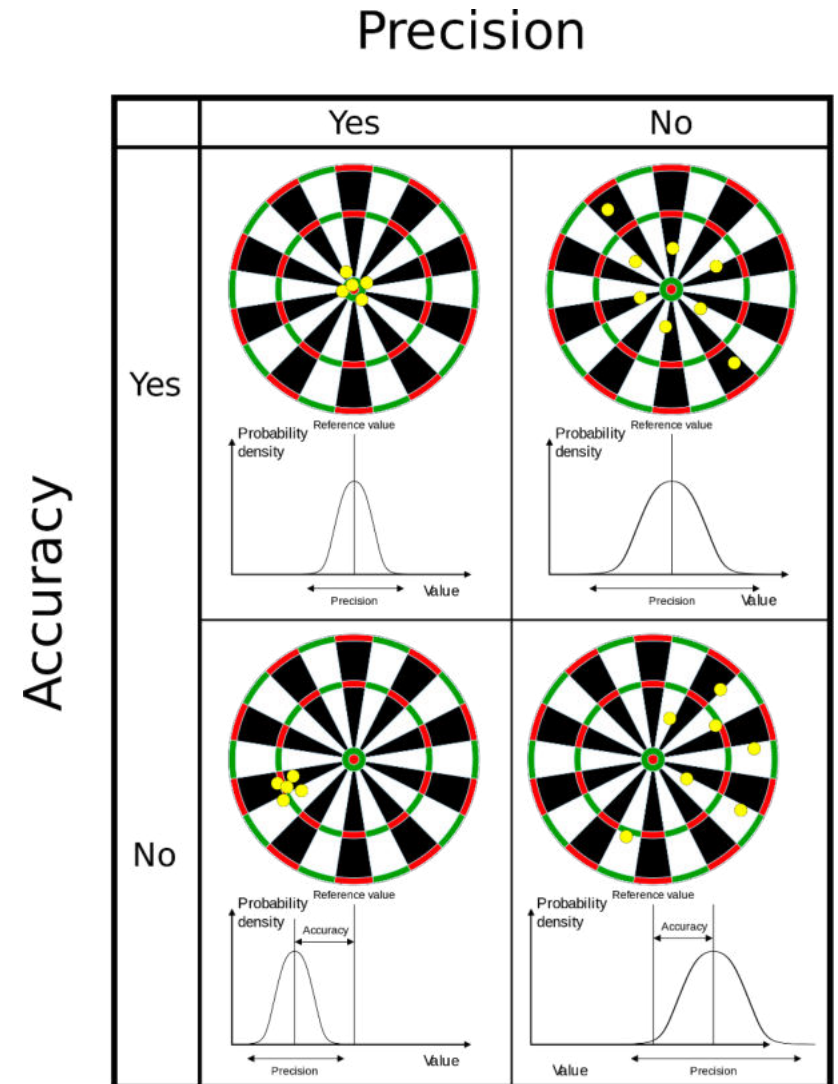
Efficiency and Equipment

- Sony A7R IV
 - 60 MP
 - Full Frame
 - Altitude for 1CM Accuracy (2xGSD)
 - 150' above ground
- DJI Phantom 4
 - 12.4 MP
 - 1/2.3" Sensor
 - Altitude for 1CM Accuracy (2xGSD)
 - 50' above ground



Highest Map Accuracy

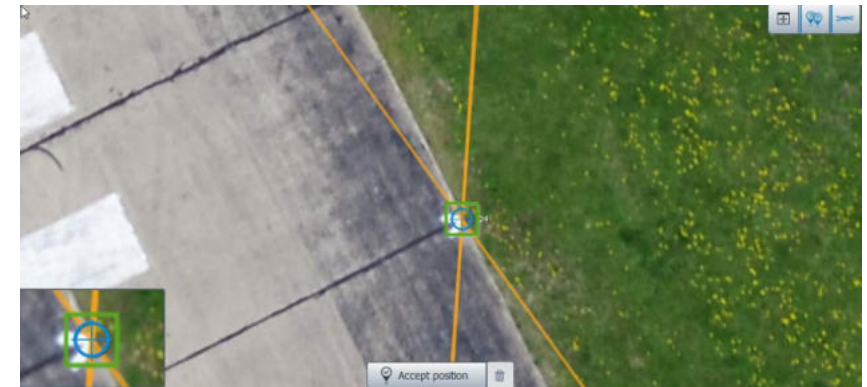
- Good Camera
- Good Camera Calibration
- Imagery Overlap.... What is a good amount?
- UAV GPS Signal
 - PPK/RTK
 - RTK -> Photo
- Ground Control Points
 - How Many?
 - How was it captured?
- Software AT algorithm
- Software GPS drift corrections



Checkpoints and Accuracy

Will you ever get centimeter accuracy over a site

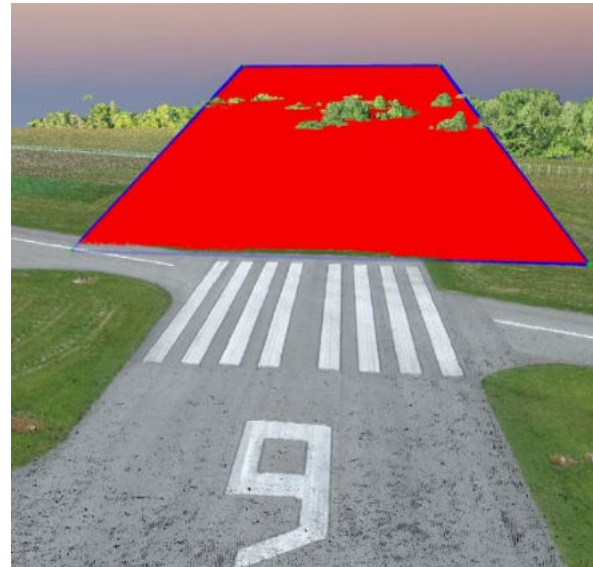
- Yes but only in perfect conditions.
- ASPRS
 - 25 Checkpoints
- NSSDA (National Standard of Spatial Data Accuracy)
 - 20 Checkpoints
- What is the accuracy of the RTK GPS?
- Quick Estimate = $2 \times \text{GSD}$



But do I really need that accuracy?

Categories of UAS projects for AEC

- Non - Referenced
 - Cool Pictures
 - Construction Observation / Documentation
 - Asset Inspections
 - Virtual Reality
- Referenced
 - Updated Ortho-Imagery
 - Full Survey
 - Cut/Fill analysis



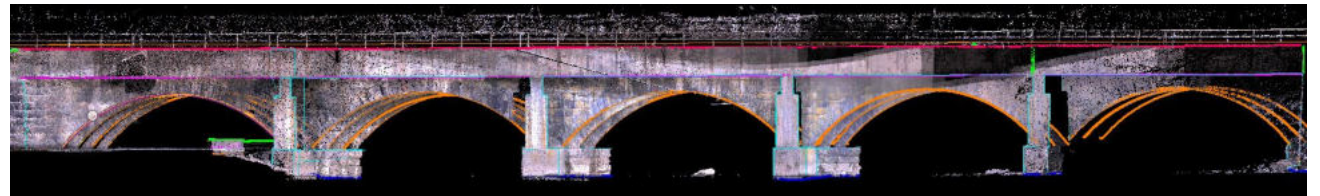
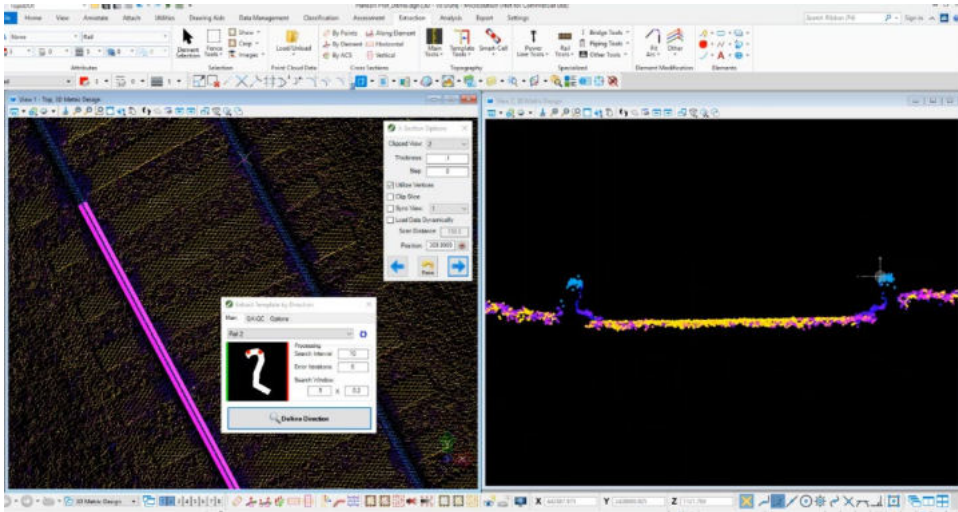
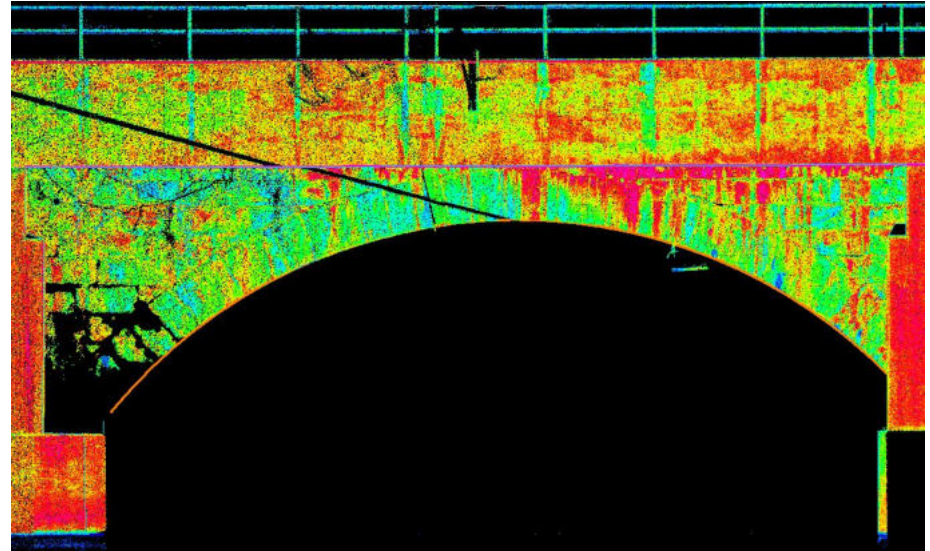
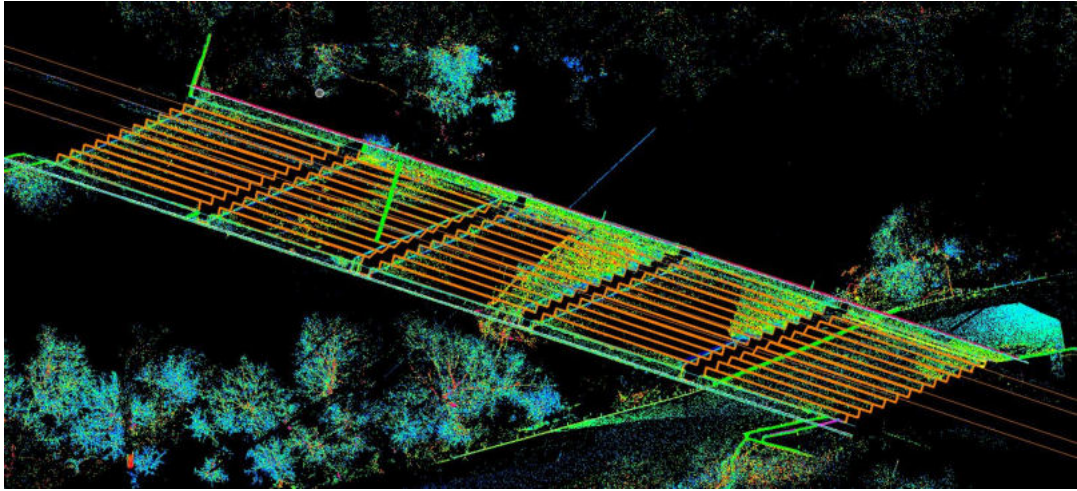
Software

- Not all software is created equal
- Online vs. In Office
- LIDAR vs. Imagery



Blended Datasets

TopoDOT



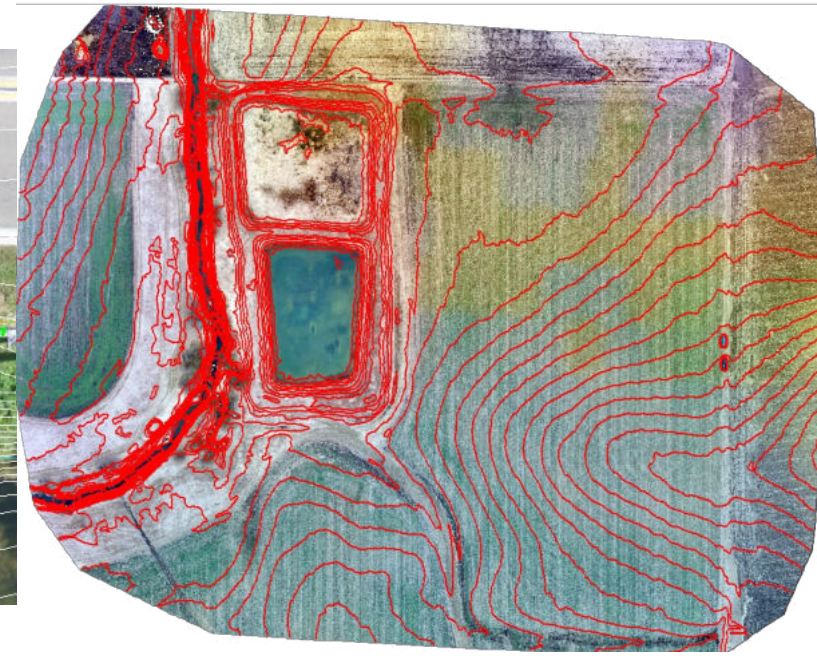
Water Resources

- Dam/Levee Inspections
- Drainage Studies
- Volume analysis
- HEC models
- Impervious surface analysis

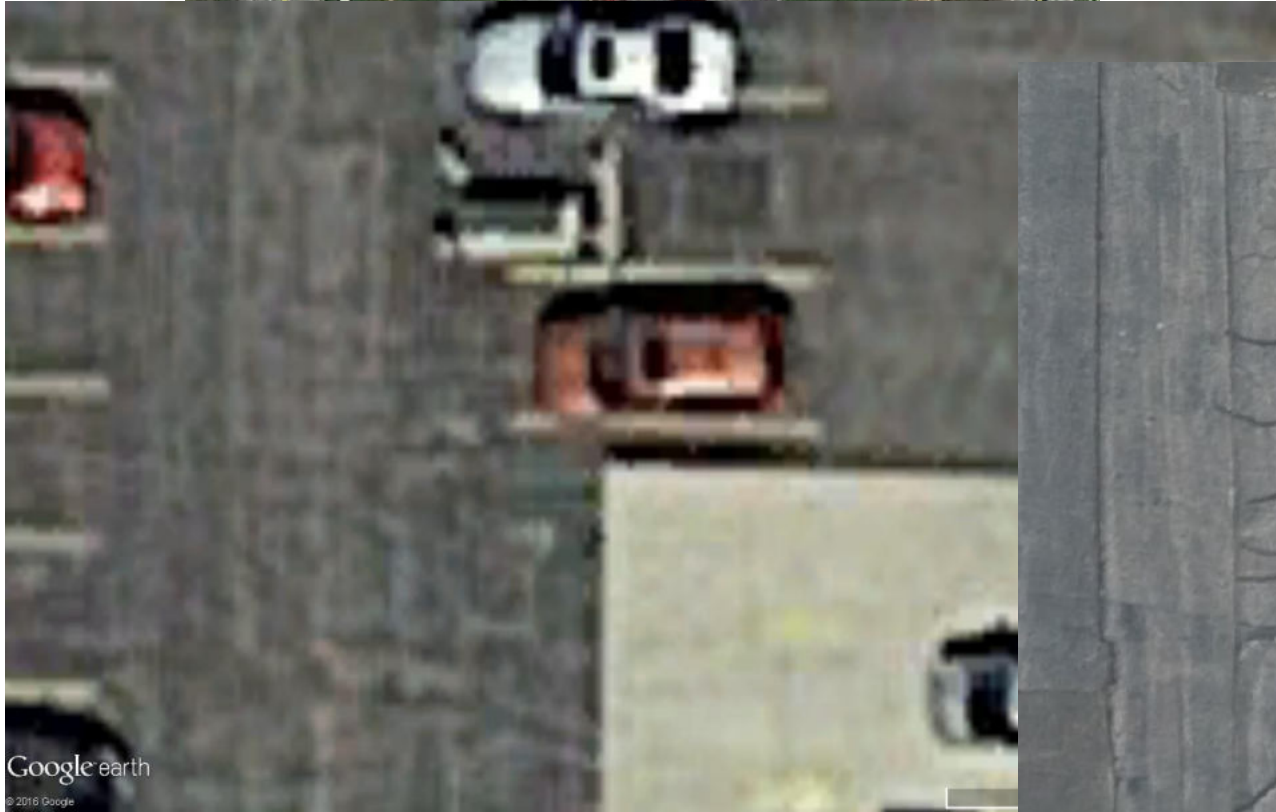


Topographic Survey

- Profiles and Cross Sections
- Georeferenced 3D Models
- Volume Calculations
- Planimetric information
- 80 Acres +/-
 - 1 hour on site
 - 4 hours processing
 - DTM, ortho's



Hanson Corporate Office Google Earth Comparison

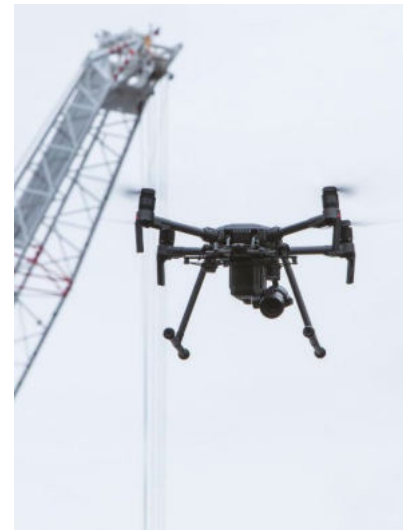


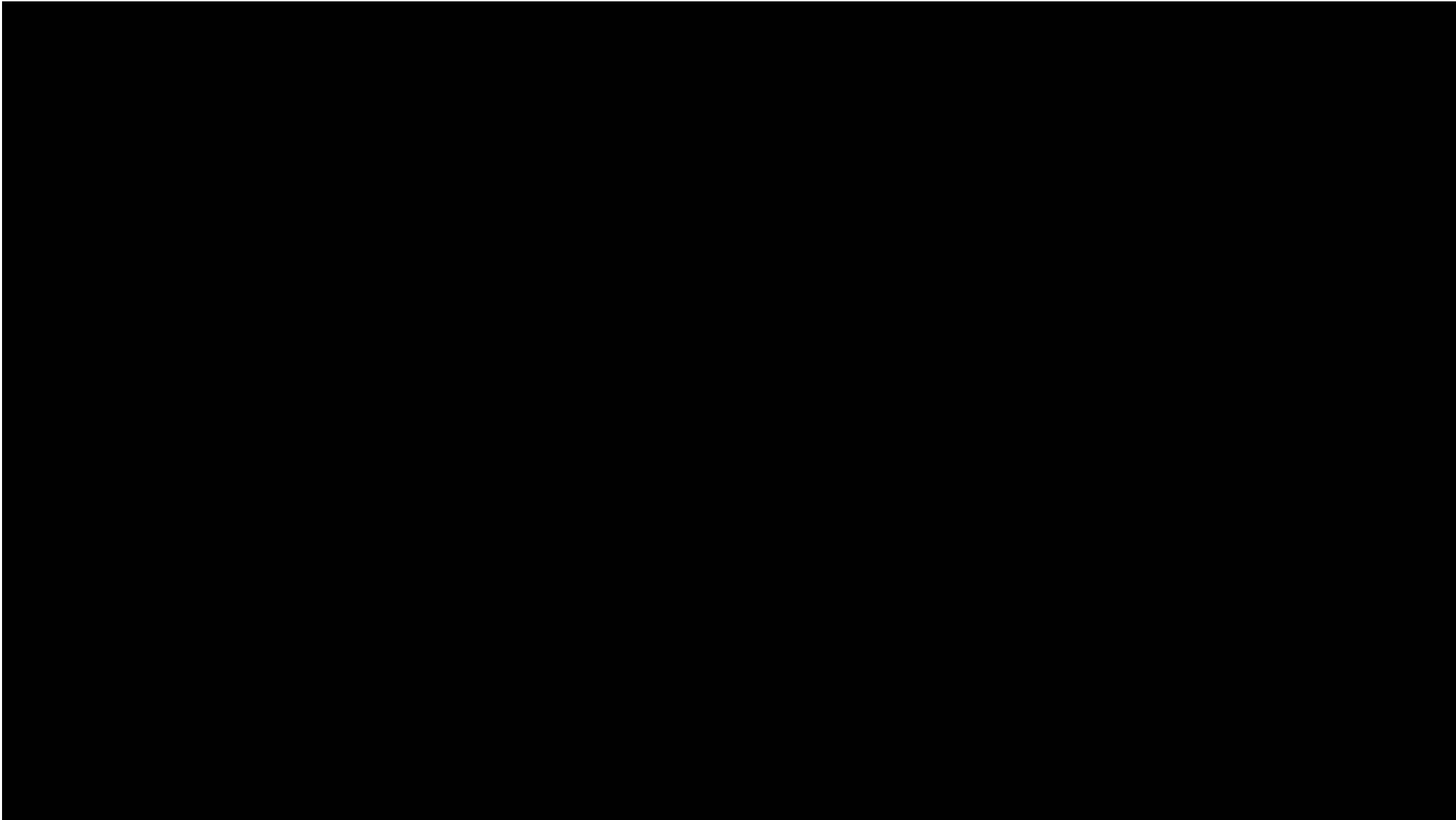
Google earth
© 2016 Google

© 2016 Google

S 6th St

UAV data for VR

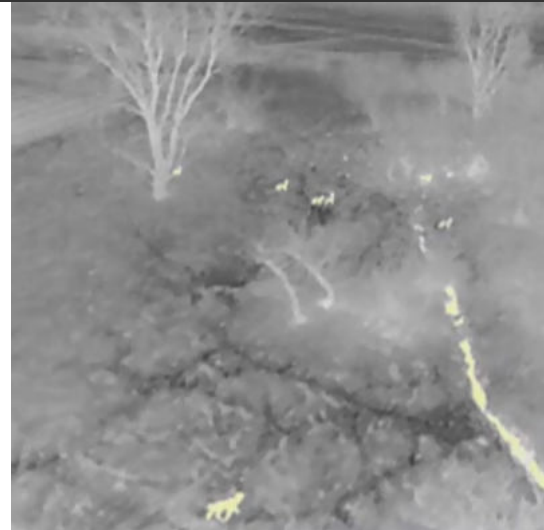
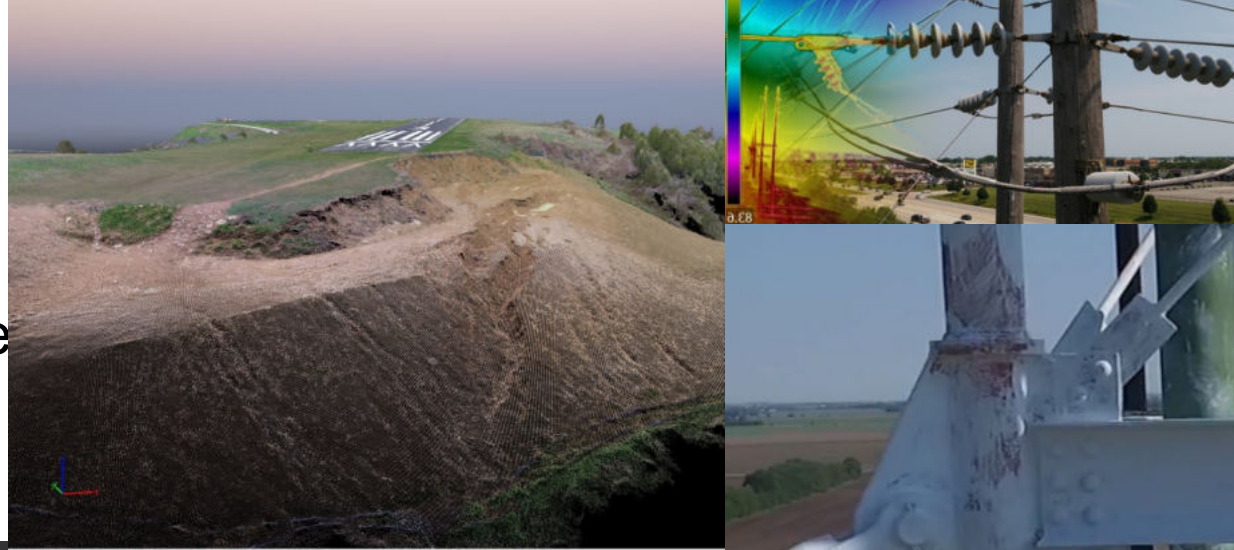






1 Million Other UAS Uses

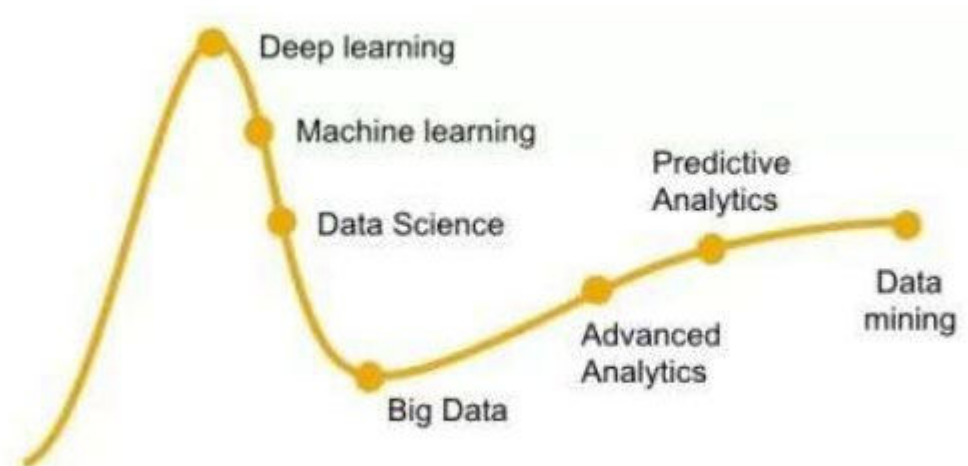
- Obstruction Surveys/Vegetation Management
- Pavement Condition Surveys
- Drainage Studies
- Topographic Surveys
- Asset Management
- Structure Surveys
- Environmental Surveys
- Cooling Tower Inspection
- Boiler Inspections
- Virtual Reality
- Rail Monitoring
- Disaster Response





The Future of Drones in AEC

- Automation
- New/Better Sensors
 - GPR, Camera's
- Machine Learning
 - Inspections
- BVLOS
 - BNSF



Questions?

