



GEOTECHNICAL APPLICATIONS OF UNMANNED AERIAL SYSTEMS (UAS)

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- What is UAS
- Applications
 - Geotechnical
 - Others
 - Future

Terminology:

UAS is the collective system of aircraft, sensors, personnel, software, and procedures centered around the operation of Unmanned Aerial Vehicles (UAV, or “drones”)

“Drone” or UAV (Unmanned Aerial Vehicle)

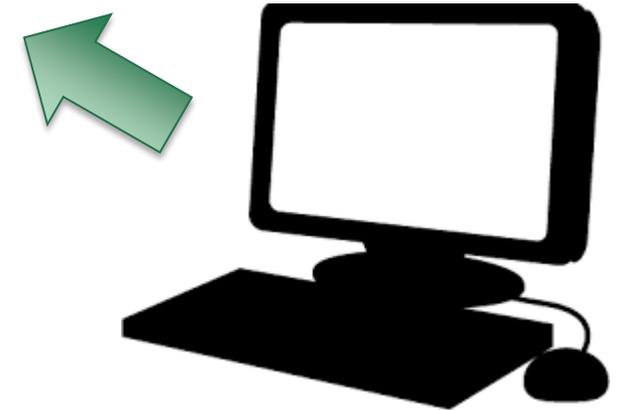


UAS

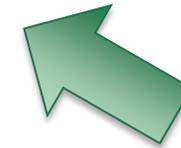
Unmanned Aerial Systems



People
(Pilots and Data Processors)

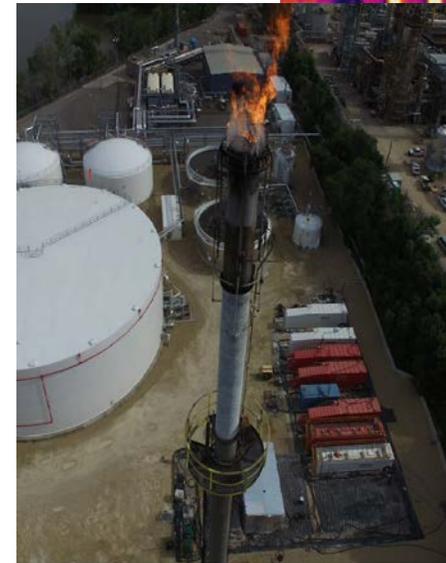
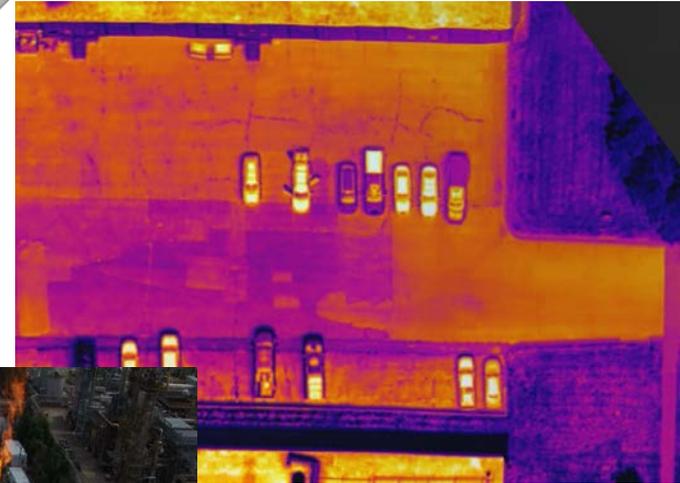


Computers & Software
(Mission Planning, Flight Operations, Processing)



Benefits of UAS

- **Safety:** by supplanting higher risk operations
- **Efficiency:** reduced labor and data gathering
- **Perspective:** allows for more informed decision making. Access areas typically not available
- **Consistency:** Simple, repeatable views allow efficient change tracking
- **Evolving:** adding new capabilities daily (gas monitoring, hyperspectral, UT, remote real-time delivery, eddy currents)



Common Geotechnical Applications of UAS

- **Geotechnical Site Assessments**

Topography, Site access, Investigation Layout

- **Engineering and Construction Management**

Slope Studies, Pre-Post Condition, Asset Management, Construction Progress

- **Planning and Environmental**

Wetland Assessment, Contaminated Site, Emergency Response

- **Structural Investigations**

Buildings, Bridges, Industrial Facilities, Solar/Wind Farms

Geotechnical: Condition Survey – Rock Fall Monitoring

Objective: Rock Fall Risk Analysis and Mitigation Plan

UAS Benefits: Safety, Efficiency, Wider Risk Mitigation, Unmatched Detail

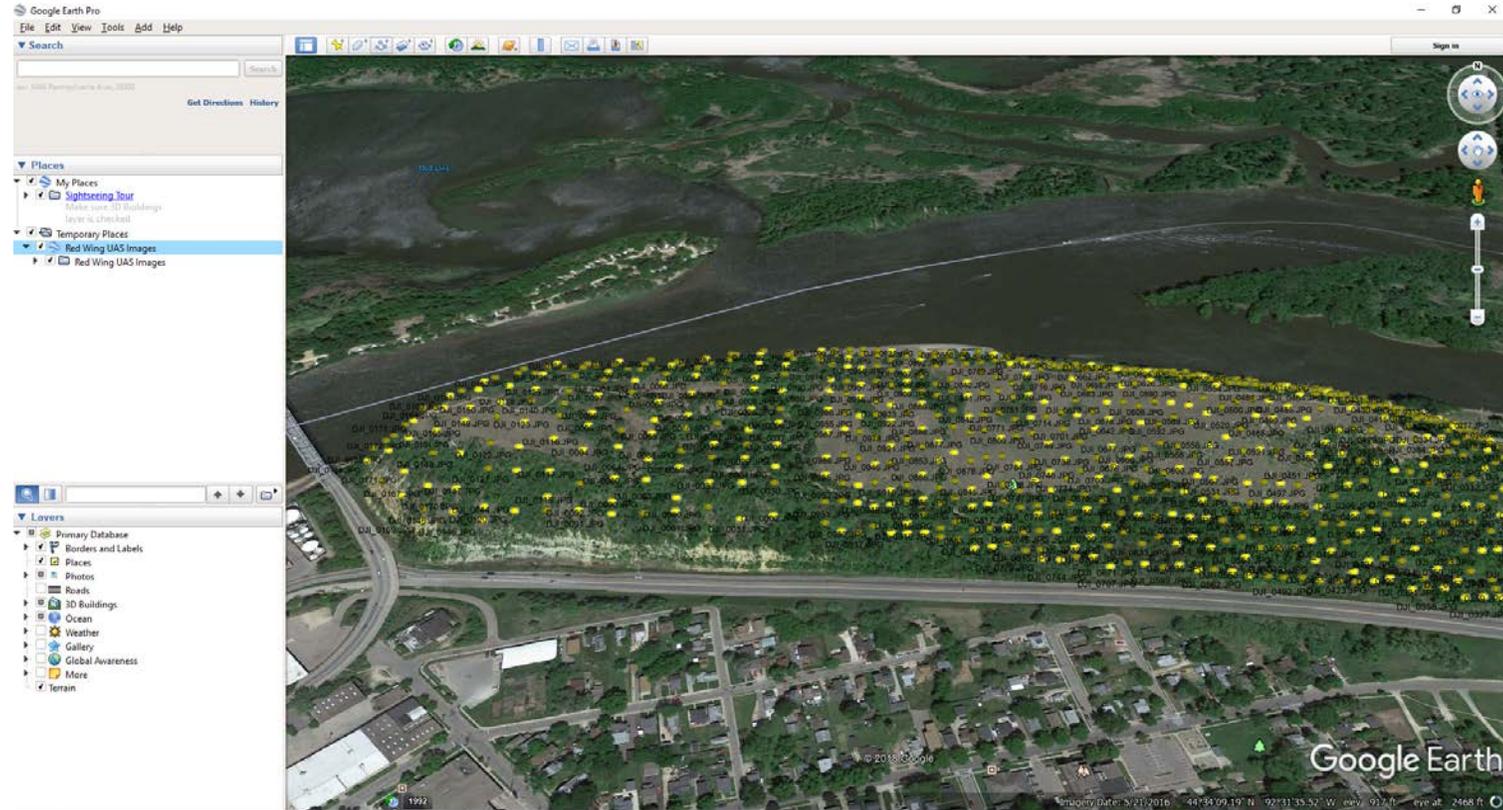


VS.



Geotechnical: Condition Survey – Rock Fall Monitoring

- Grid Pattern – Recording flight details for repeatability
- Mix of video, stills and thermal
- Focused on high risk areas



UAV Point Map

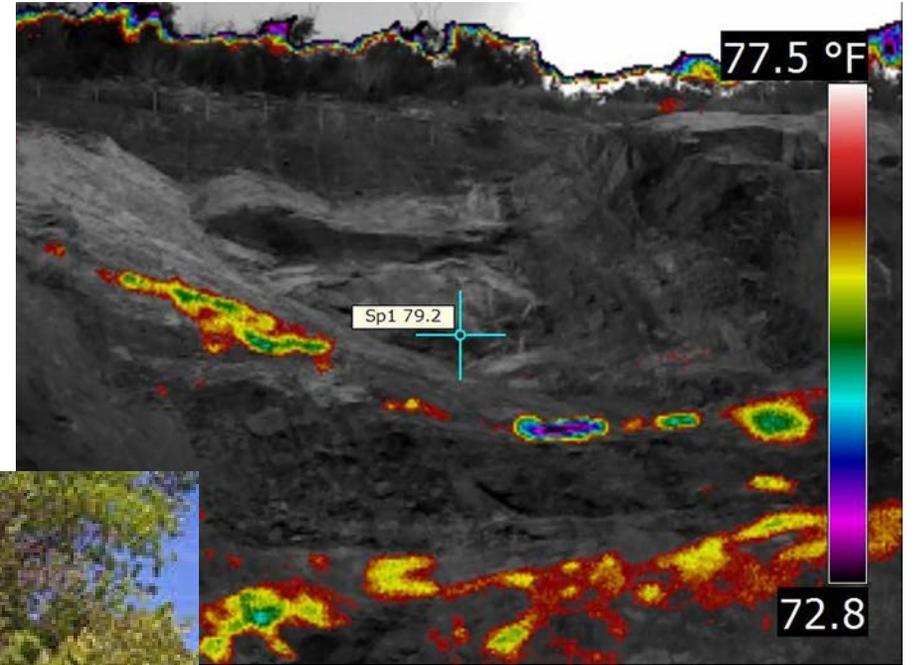


Barn Bluff Vibration Study4.kmz

Geotechnical: Condition Survey – Rock Fall Monitoring

Thermal imaging

- Monitor perched water and water flow
- Identify high-risk locations



Geotechnical: Condition Survey – Rock Fall Monitoring

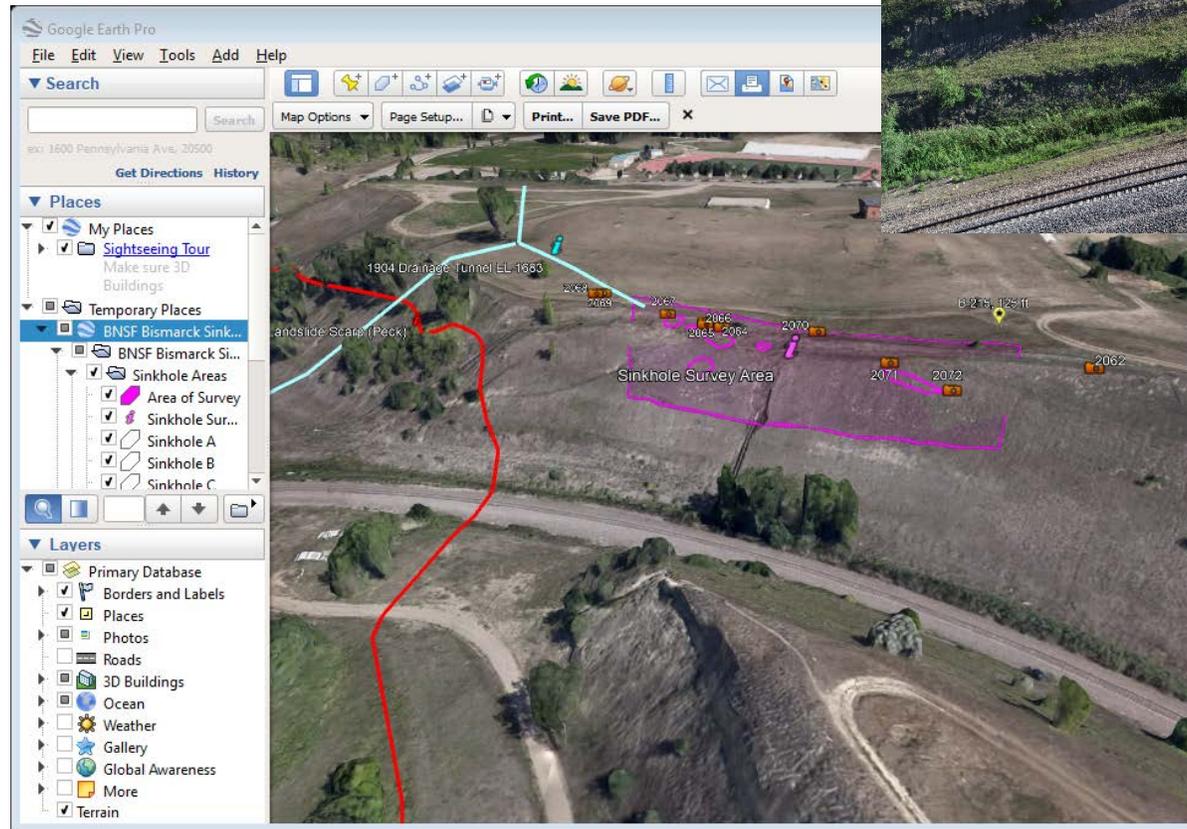
- Optical Camera – Rock Face No LIDAR needed
- Used in conjunction with Vibration Monitoring and Rock Quality Testing
- Human post-construction assessment
 - AI is an option
 - Could monitor movement
- Very successful project



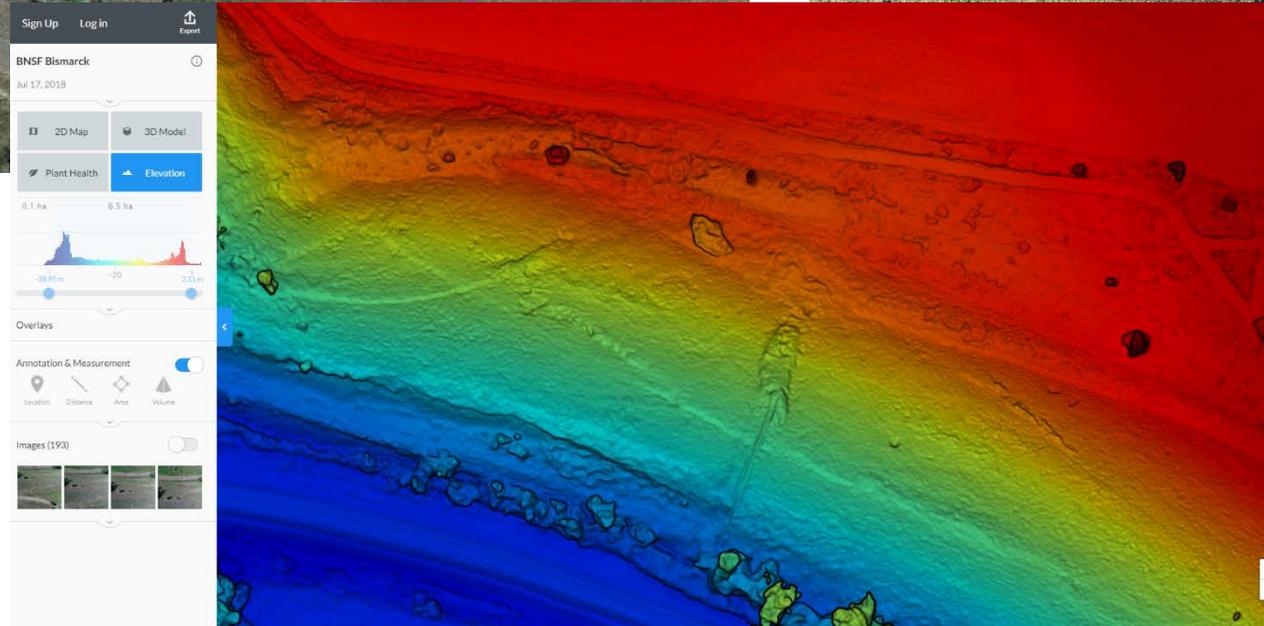
Geotechnical: Sinkhole and Investigation Identification

Objective: Map sinkholes, map drainage features, 3D plot entire slope

UAS Benefits: identify hidden sinkholes, safety, efficiency, real-time mapping



Geotechnical: Sinkhole and Investigation Identification



Geotechnical: Sinkhole and Investigation Identification



3D Model

Other Transportation: Linear Corridor Inspection

County Ditch Inspections

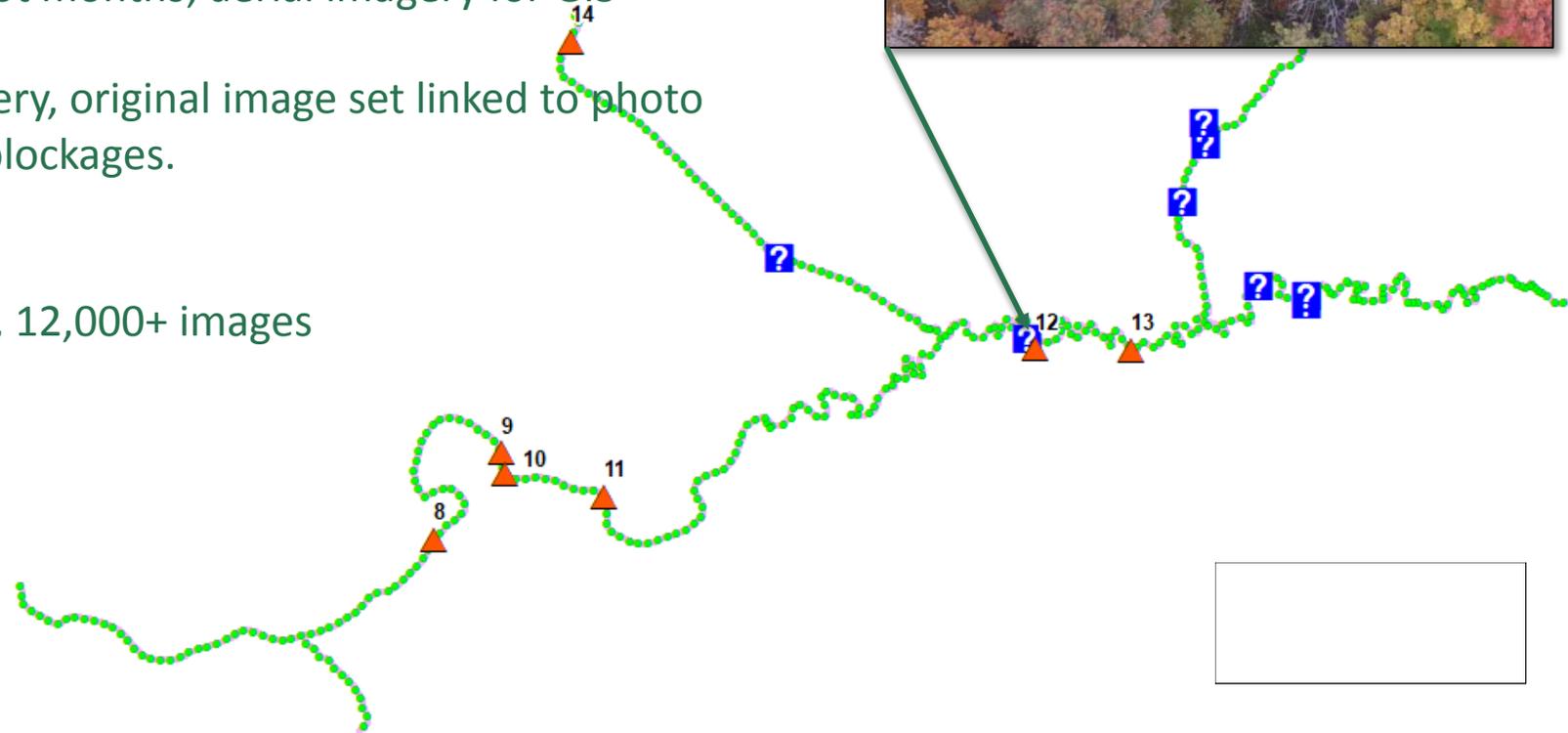
Objective: Utilize UAS to capture high resolution imagery of the County Ditch system, creating georeferenced orthomosaics and analyzing the data for potential blockages and spills.

UAS Benefits: Workers did not have to spend weeks traversing through wetland conditions, data collection in days, not months; aerial imagery for GIS

Deliverable: GIS-enabled aerial imagery, original image set linked to photo features, and a dataset of potential blockages.

Project Details:

Three full weeks of flights, 153 miles, 12,000+ images



Other Transportation: Construction Management

Construction Site Assessments

Objective: Capture timely site assessment imagery of construction sites for reporting and analysis.

UAS Benefits: Safe and accurate stockpile measurements, safe and comprehensive progress monitoring, repeatable time-lapse aerials

Deliverable: Stockpile model and quantity calculations, sequenced site condition overlays, aerial photography



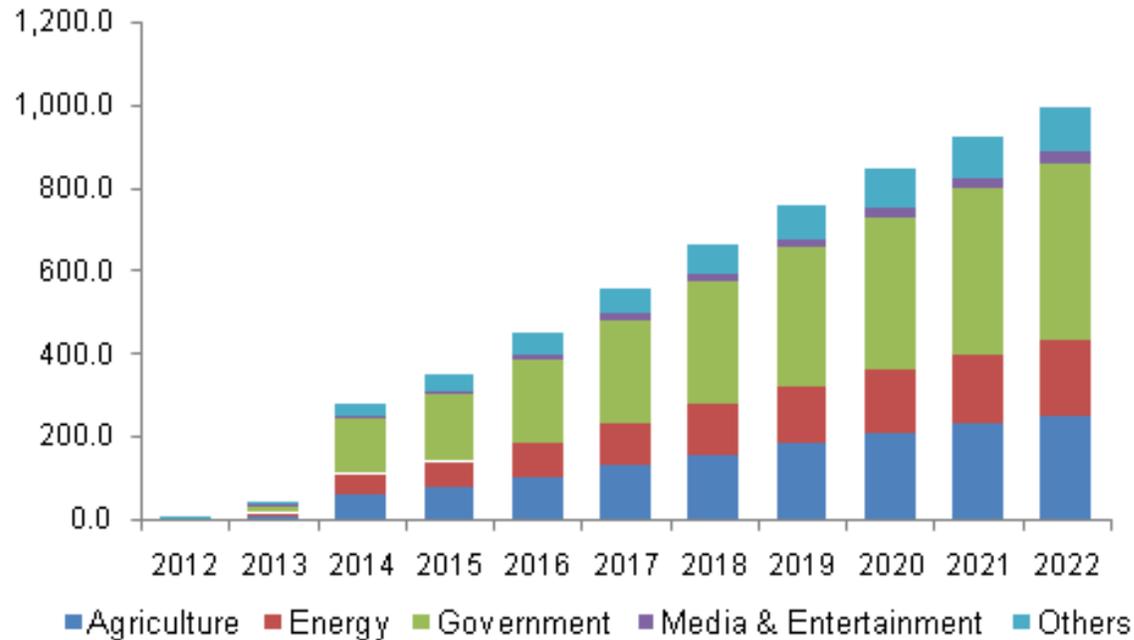
3D Model Textured Mesh



Job Site Monitoring



UAS is Here, and More is Coming



<https://www.grandviewresearch.com/industry-analysis/commercial-uav-market>

Many experts in the drone industry suggest that the most powerful applications of drones have not even been discovered, yet.

- Delivery
- Emergency Management
- Farming and Agriculture
- Law Enforcement

UNMANNED AERIAL SYSTEMS (UAS)

QUESTIONS ?

Please contact us with any questions:



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