Field Data Procurement Using Unmanned Aerial Vehicles (UAV) and Laser Scanning

CS10829

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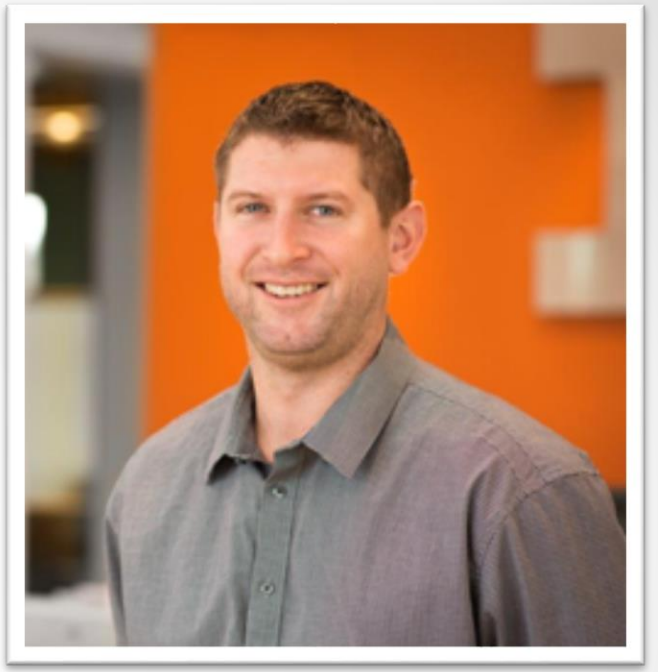
Class summary

The ever-growing quest for faster and more-accurate field data has been fueled by the increase in computing power and the decrease of equipment costs for unmanned aerial vehicles (UAVs) and laser scanners. The democratization of both types of data procurement helps continue the growth in areas of construction and engineering that were unthought-of a few years ago. The UAV may be the greatest thing since the Internet. From reducing risk on dangerous work to simplifying surveying and mapping tasks, we have yet to see the full potential. Laser scanning is very similar and was once thought of as an inaccurate science, but it has broken through this stigma and is now a common practice. This presentation will dive into the many uses of UAVs and laser scanning in heavy civil design, engineering, and construction. We will discuss the legality of their uses and show examples of their potential uses. See how these types of data procurement are being applied daily. The future is here!

Who are we and what do we do?

Brian K. Smith
Director of Technology

Oversees BIM, VDC, IT, GPS & SURVEY
18 Years in Civil Construction
Hydroelectric, Water/Wastewater, Roads, Bridges, Airports
Instructor at Washington Engineering Institute

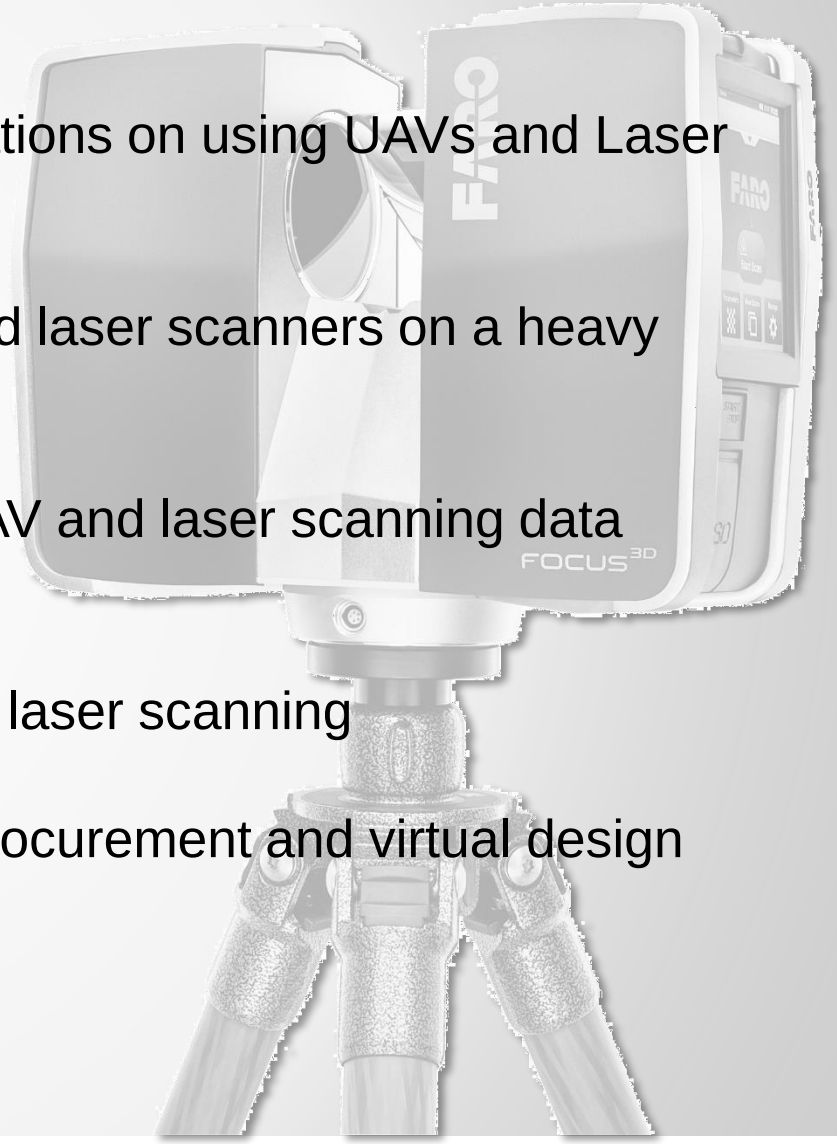


Sam Kloes aka Satellite Whisper
GPS / Survey Manager

Oversees GPS, Survey and AMG Program
14 Years in Civil Construction
Transportation
Water / Wastewater / Heavy Civil
Instructor at Washington Engineering Institute
NCCER certified instructor

Key learning objectives

- Discover the current laws and regulations on using UAVs and Laser scanning
- Explore the current uses of UAVs and laser scanners on a heavy civil construction site
- Learn about different methods for UAV and laser scanning data collection
- Discover the limitations of UAVs and laser scanning
- Understand the big picture of data procurement and virtual design and construction



UAV's and Laser Scanning

UAV's
Began in 1900's always for military applications until 2000's when commercial activity began.

Laser Scanning
Began in 1960's but did not break into commercial areas until late 90's.

The Legality of UAV's

What are the current FAA rules?

There are 3 Types of Approved UAV Operations

- Public Operations (Governmental)
- Civil Operations (Non-Governmental)
- Model Aircraft (Hobby-Recreational)

The Legality of UAV's

What are the current FAA rules for Civil Operations?

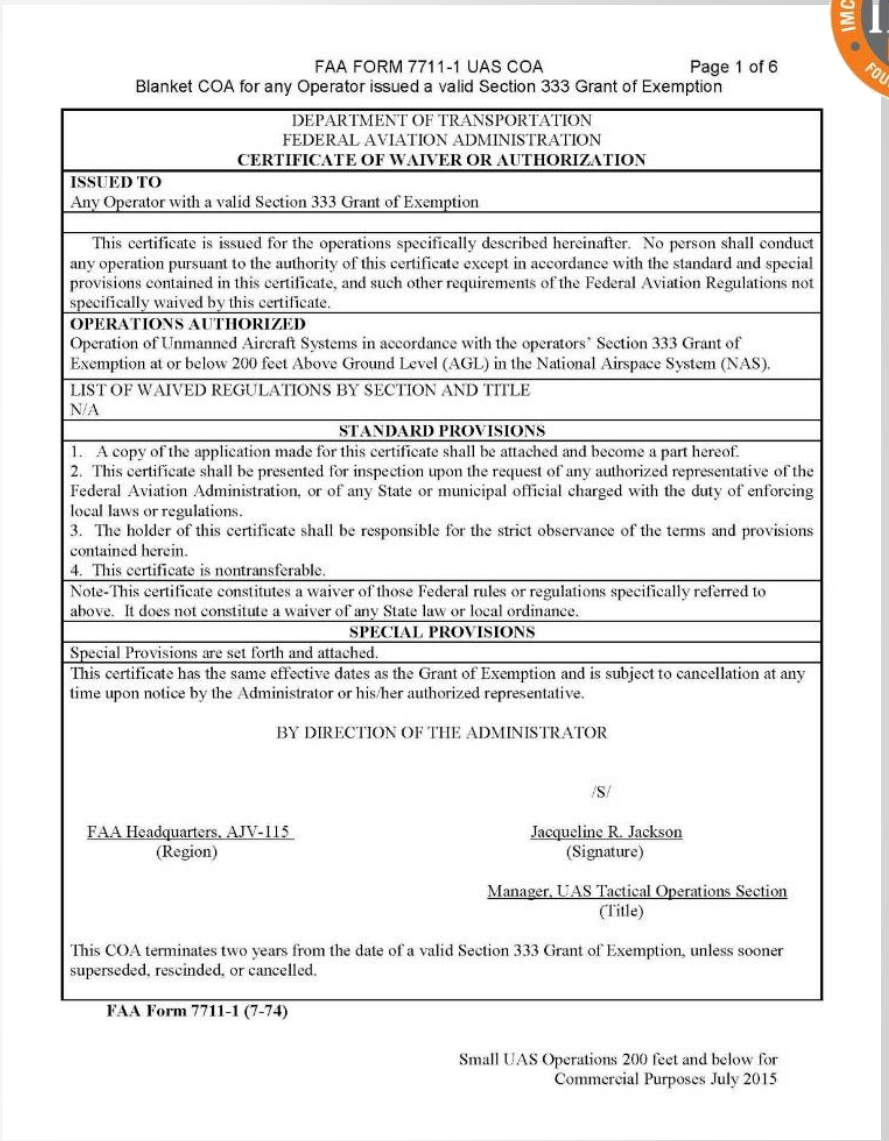
- Section 333 Exemption and a COA (Certificate of Waver of Authorization)
- Special Airworthiness Certificate (SAC)

Federal Aviation Administration

The Legality of UAV's

What are the current FAA rules for the Section 333 Exemption and a COA?

- Ceiling of 400' AGL
- Max Take off weight = 55 lbs
- Operate in (VLOS) Visual Line of Sight
- Max Ground Speed = 50 knots
- Daylight use only
- PIC (Pilot in Command) must be certified Pilot
- Must use Visual Observer (VO)
- File NOTAM (Notice to Airmen) min. 24 hrs before flight



FAA FORM 7711-1 UAS COA Page 1 of 6
Blanket COA for any Operator issued a valid Section 333 Grant of Exemption

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Any Operator with a valid Section 333 Grant of Exemption

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Operation of Unmanned Aircraft Systems in accordance with the operators' Section 333 Grant of Exemption at or below 200 feet Above Ground Level (AGL) in the National Airspace System (NAS).

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions are set forth and attached.

This certificate has the same effective dates as the Grant of Exemption and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

/S/

FAA Headquarters, AJV-115 (Region)

Jacqueline R. Jackson (Signature)

Manager, UAS Tactical Operations Section (Title)

This COA terminates two years from the date of a valid Section 333 Grant of Exemption, unless sooner superseded, rescinded, or cancelled.

FAA Form 7711-1 (7-74)

Small UAS Operations 200 feet and below for Commercial Purposes July 2015

The Legality of UAV's

What are the proposed FAA Civil Operation rules?

- Ceiling of 500' AGL
- Max Take off weight = 55 lbs
- Operate in (VLOS) Visual Line of Sight
- Max Ground Speed = 86 knots
- Daylight use only
- PIC (Pilot in Command) must pass knowledge test
- Must use Visual Observer (VO)
- File NOTAM (Notice to Airmen) min. 24 hrs before flight

The Legality of UAV's

Why do we need these rules?

- Public safety in populated areas
- Control of FAA Airspace
- Future UAV industry growth
- Keep pilots accountable

Current Uses for UAV's

Civil and Commercial Applications:

Security

- Security and Control
- Aerial Reconnaissance
- Aerial Policeman and Crowd Monitoring
- Aerial Traffic and Security Watch

Current Uses for UAV's

Civil and Commercial Applications

Search and Rescue

- Maritime and Mountain Search and Rescue
- Life raft Deployment
- Rescue point marking

Current Uses for UAV's

Civil and Commercial Applications

Monitoring

- Civil engineering sites
- Waterways and shipping
- Oil and gas pipeline
- Forestry
- Fishery Protection
- Pollution Control and Air Sampling

Current Uses for UAV's

Civil and Commercial Applications

Disaster Management

- Disaster effects management
- Rescue and clear up effort supervision
- Disaster damage estimation

Current Uses for UAV's

Civil and Commercial Applications

Crop Management

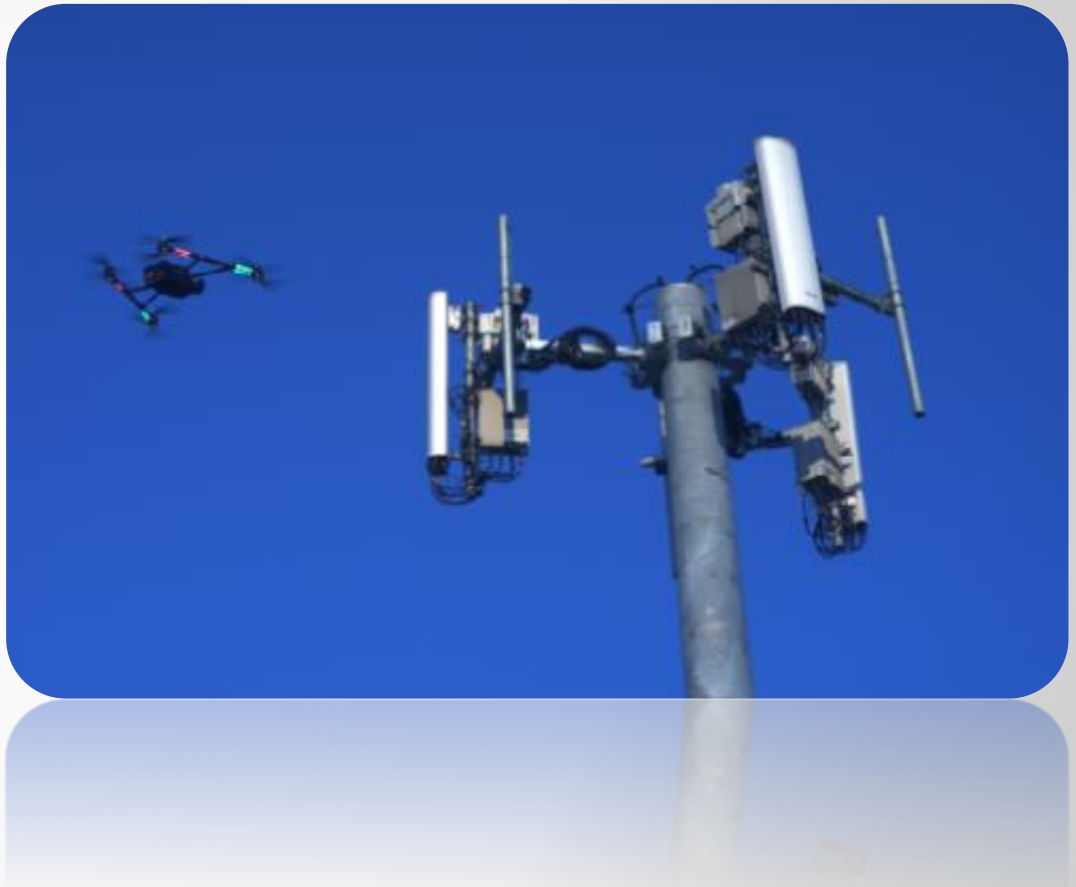
- Countryside and Agriculture
- Agricultural Activities
- Crop Dusting

Current Uses for UAV's

Civil and Commercial Applications

Communications

- Telecommunications
- Telecom relay and signal coverage survey

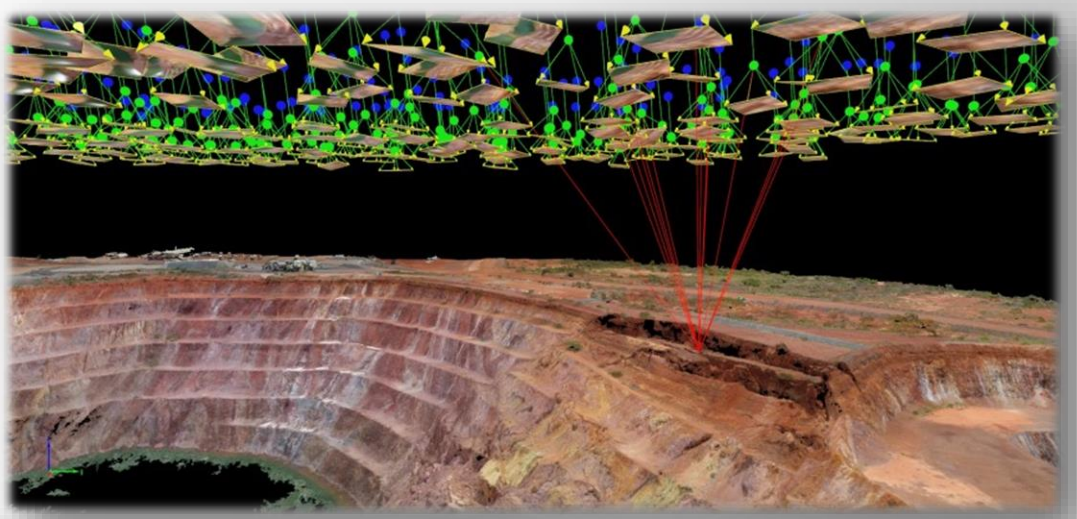


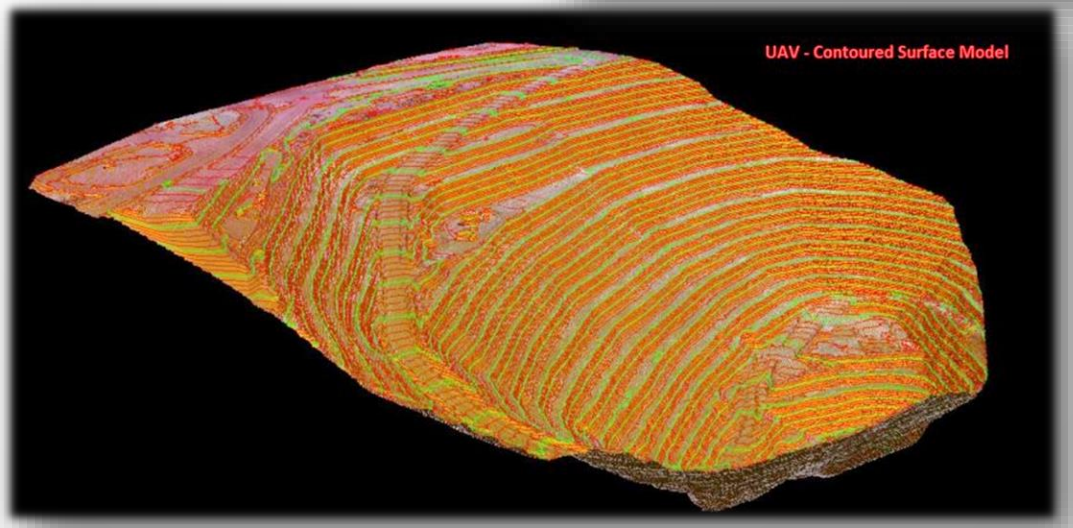
Current Uses for UAV's

Civil and Commercial Applications

Survey

- Oil and Gas Exploration and Production
- Mineral exploration
- Geophysical surveys





Data Collection Methods Using UAV's

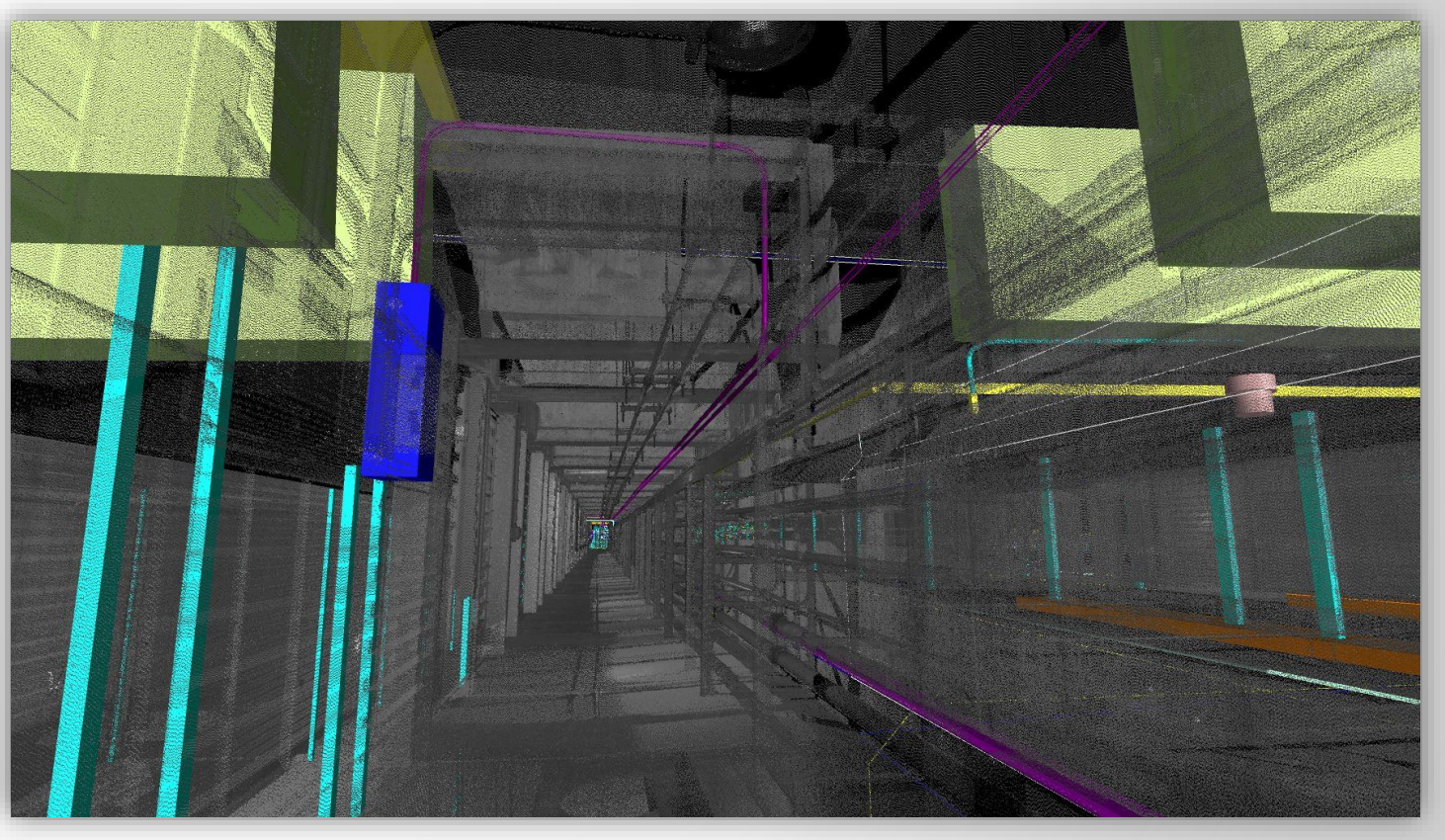
- Optical
  - Photogrammetry
  - Pictures
  - Video
  - Thermal imaging
  - Infrared imaging
- Acoustic
- Laser
  - Lidar
  - Range finder

Limiting Factors for Using UAV's

- FAA Regulation
- Environmental conditions
  - Weather
  - Day flights only (by FAA)
  - Debris
- Guidance and Control
  - Outdoor
    - Poor GPS
    - Large Buildings, water
  - Indoor (needs GPS)
  - Battery life
  - Object awareness

Limiting Factors for Using Laser Scanners

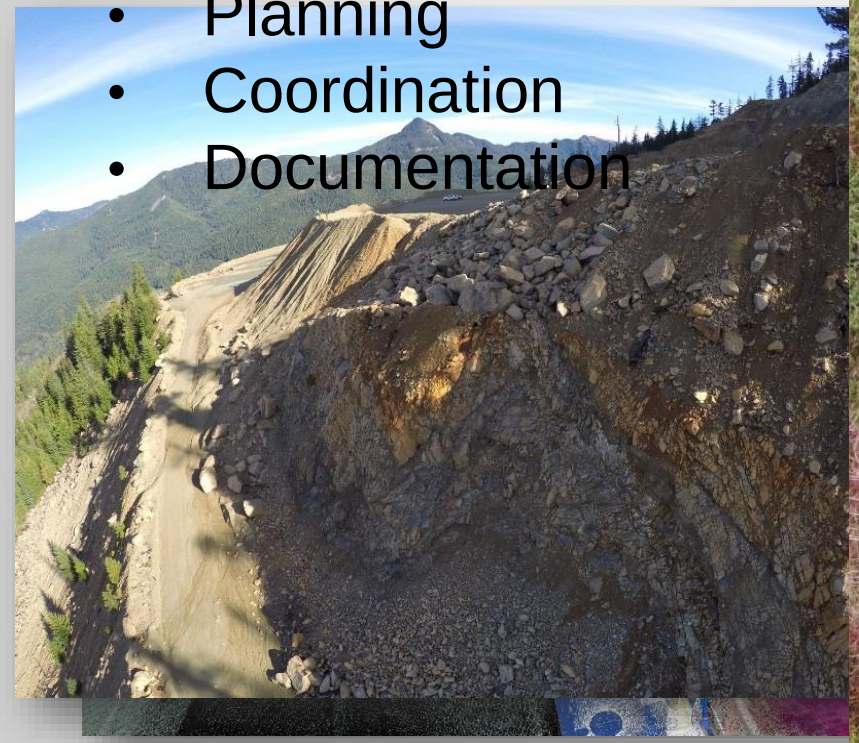
- Complicated data post processing
- Highly expensive for whole workflow
- Shadows in scanning (LOS)
- Reflectivity
- Speed
- Still Very Manual
- Large file sizes
- Finite Survey Needed to reference data into coordinate system



Where is the Magic?

How does IMCO utilize UAV's?

- Safety
- Planning
- Coordination
- Documentation



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How does IMCO utilize UAV's?

- Safety
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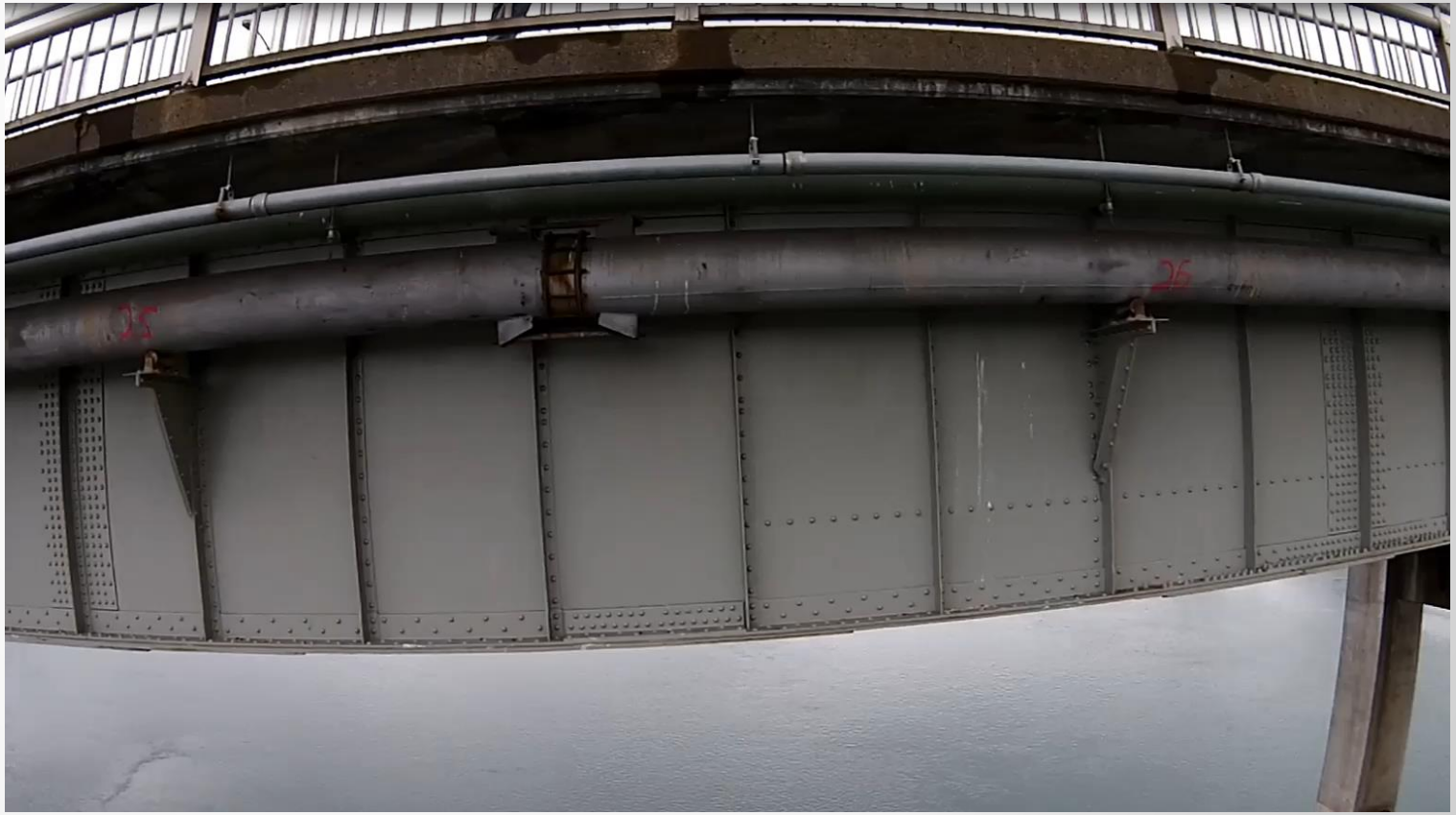

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- Production
- Stockpile quantification

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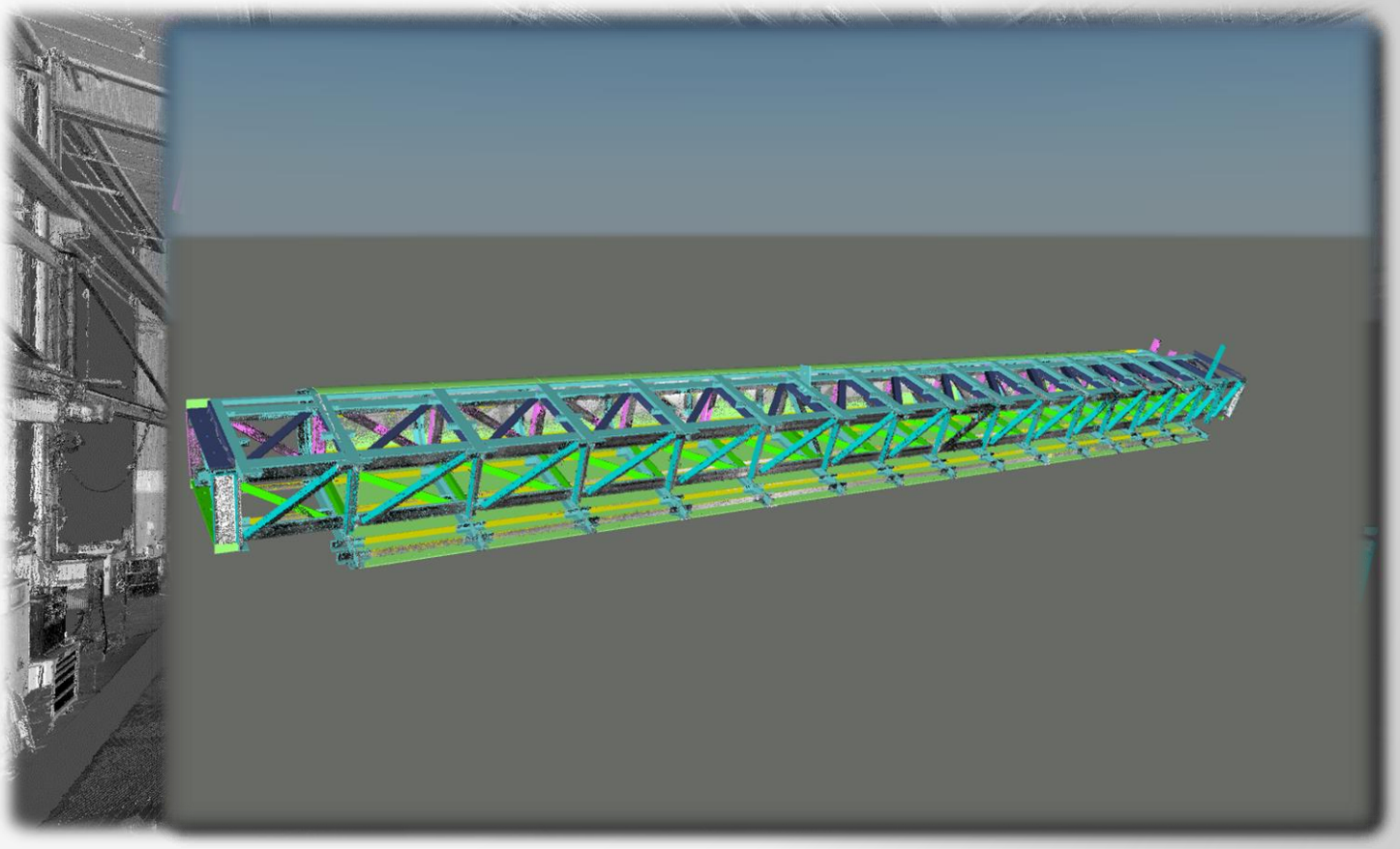
Where is the Magic?

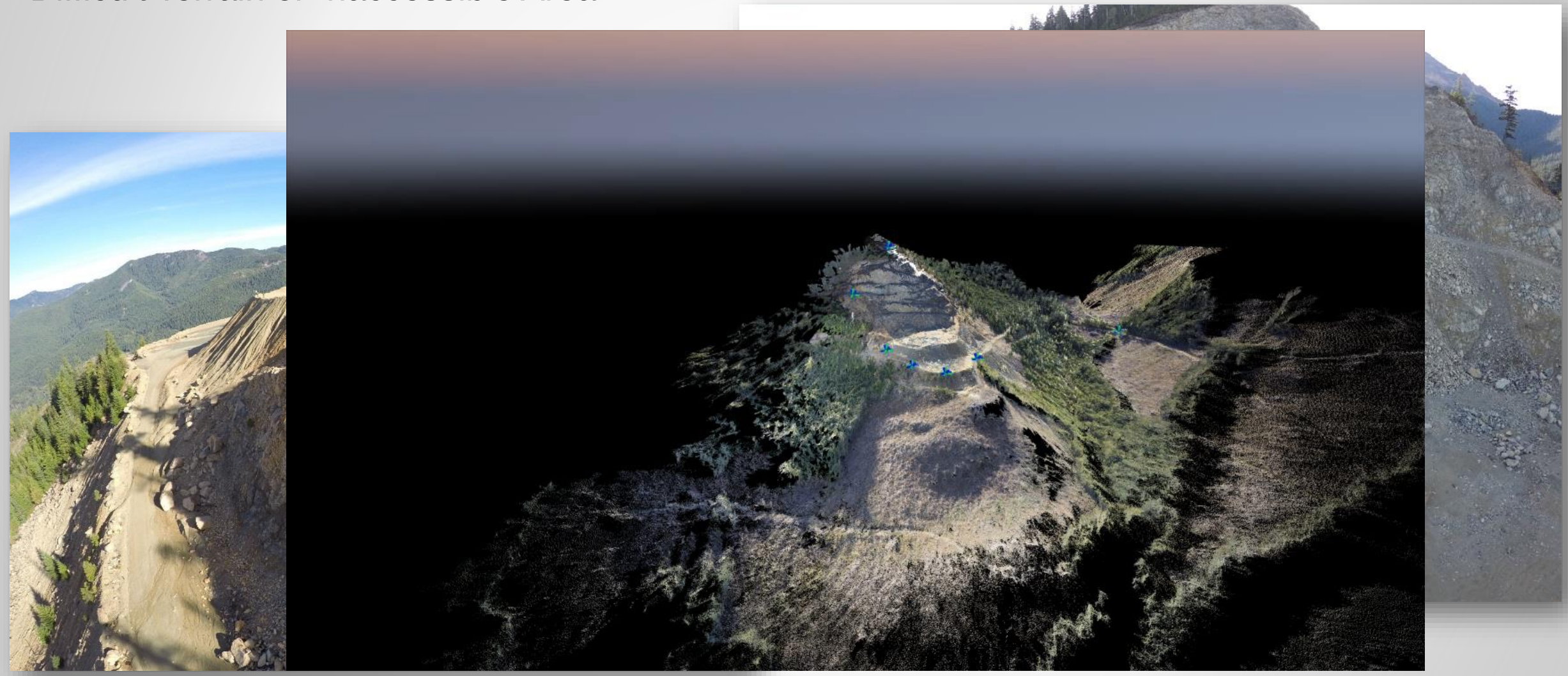
How does IMCO utilize UAV's?

- Safety
- Planning
- Coordination
- Documentation
- Inspection
- Production
- Stockpile quantification
- 3D modeling
- QA/QC



Large Scale Photogrammetry

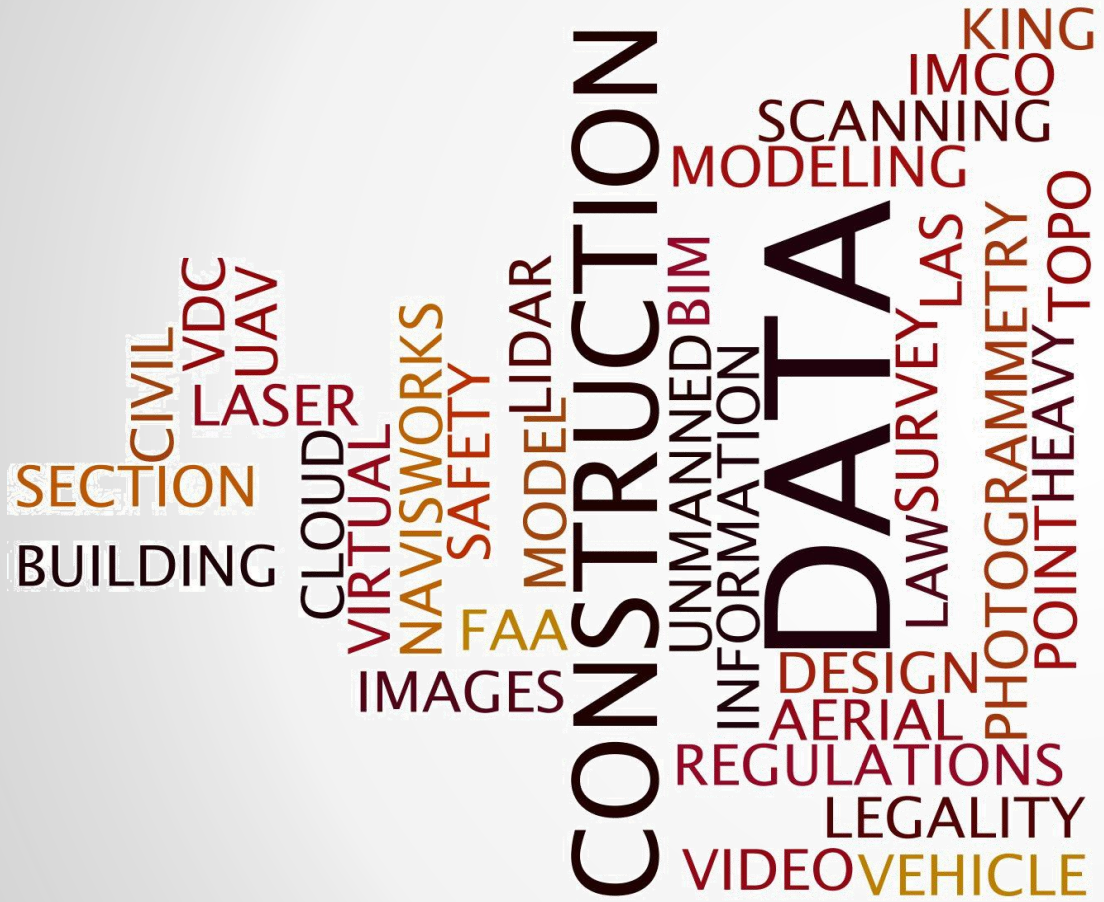
Difficult Terrain or Inaccessible Area



Accurate Point Cloud of Existing Structures

Large areas flown quickly, accurately, and safely with UAV

Don’t be Afraid of Data



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Contact Information

Thank You! Please feel free to contact either of us directly.

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