

Unmanned Aircraft Policies & Applications for DOTs

TDOT / Traffic Operations Division

By: Said El Said



Outline

- Regulations according to CFR 49 Part 107
 - Small UAS
 - Remote Pilot in Command
 - Flight Limitations
- FAA Certificate of Authorization (COA)
- UAS Transportation Applications
 - Survey Results/TDOT Interest
 - Ongoing Research for Transportation
 - Applications Examples
 - 3D Aerial Mapping and Photogrammetry
 - LiDAR
 - Crash Scene Investigation

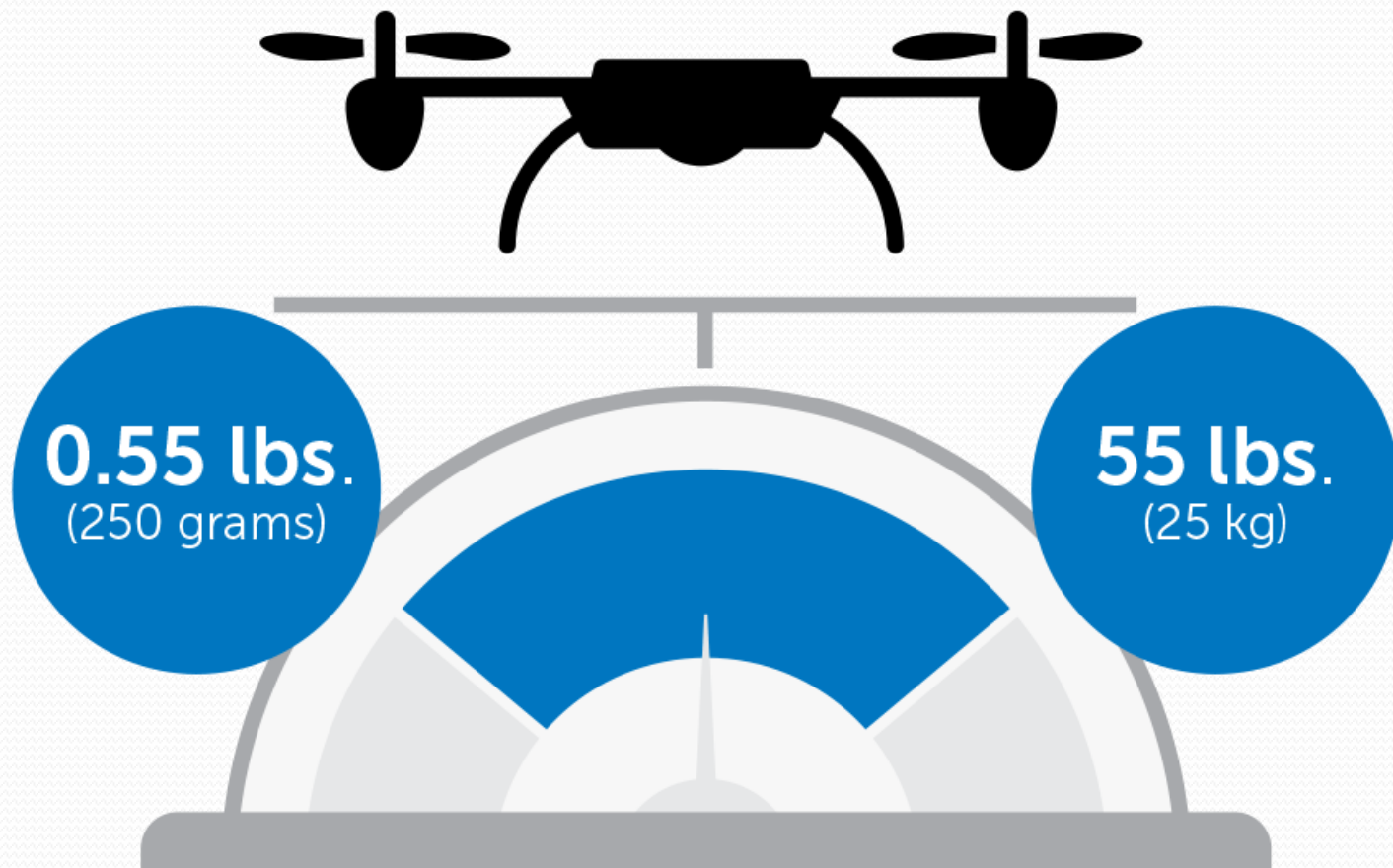
UAS for Government Entities

- Fly under the small UAS rule –14 CFR part 107, OR
- Obtain a blanket public Certificate of Waiver or Authorization (COA) – permits nationwide flights in Class G airspace at or below 400 feet, self-certification of the UAS pilot, and the option to obtain emergency COAs (e-COAs) under special circumstances

UAS for Government Entities

- To fly you will need:
 - An Unmanned Aircraft System
 - Pilot in Command
 - Operations Limits

small UAS Definition



TDOT sUAS

- Registered with the FAA N36978
- Weighing approximately 4kg (9lb)
- Maximum takeoff weight of about 11kg (25lb)

S1000
OCTOCOPTER



Payload & Flight Duration

- Payload
 - Carrying capacity of an aircraft
 - GoPro 110g or 0.24 lb
 - LiDAR 1850g or 4 lb
- Flight Duration
 - 15 minutes



<http://www.phoenix-aerial.com/>

Remote Pilot in Command

- Must have Remote Pilot Airman Certificate
- Must be 16 years old
- Must pass TSA vetting
- Able to read, speak, write, and understand English
- In a physical and mental condition to safely operate
- Pass online training course ALC-451
- Pass the initial aeronautical knowledge exam at an FAA-approved knowledge testing center. \$150

FAA Course ALC-451

<https://www.faasafety.gov/>



Certificate of Achievement

This is to certify that

Said El Said

*has successfully completed the
FAA Safety Team Aviation Learning Center Online Course*

Part 107 Small Unmanned Aircraft Systems (sUAS)

Course Number ALC-451

Presented by Online Courses

August 6, 2016



**Federal Aviation
Administration**

Certificate Number 0838429-20160806-00451

Valerie G. Palazzolo
Valerie G Palazzolo, National Manager, FAA Safety Team

Certificate of Achievement

This is to certify that

Khuzaima Mahdi

*has successfully completed the
FAA Safety Team Aviation Learning Center Online Course*

Part 107 Small Unmanned Aircraft Systems (sUAS)

Course Number ALC-451

Presented by Online Courses

August 9, 2016



**Federal Aviation
Administration**

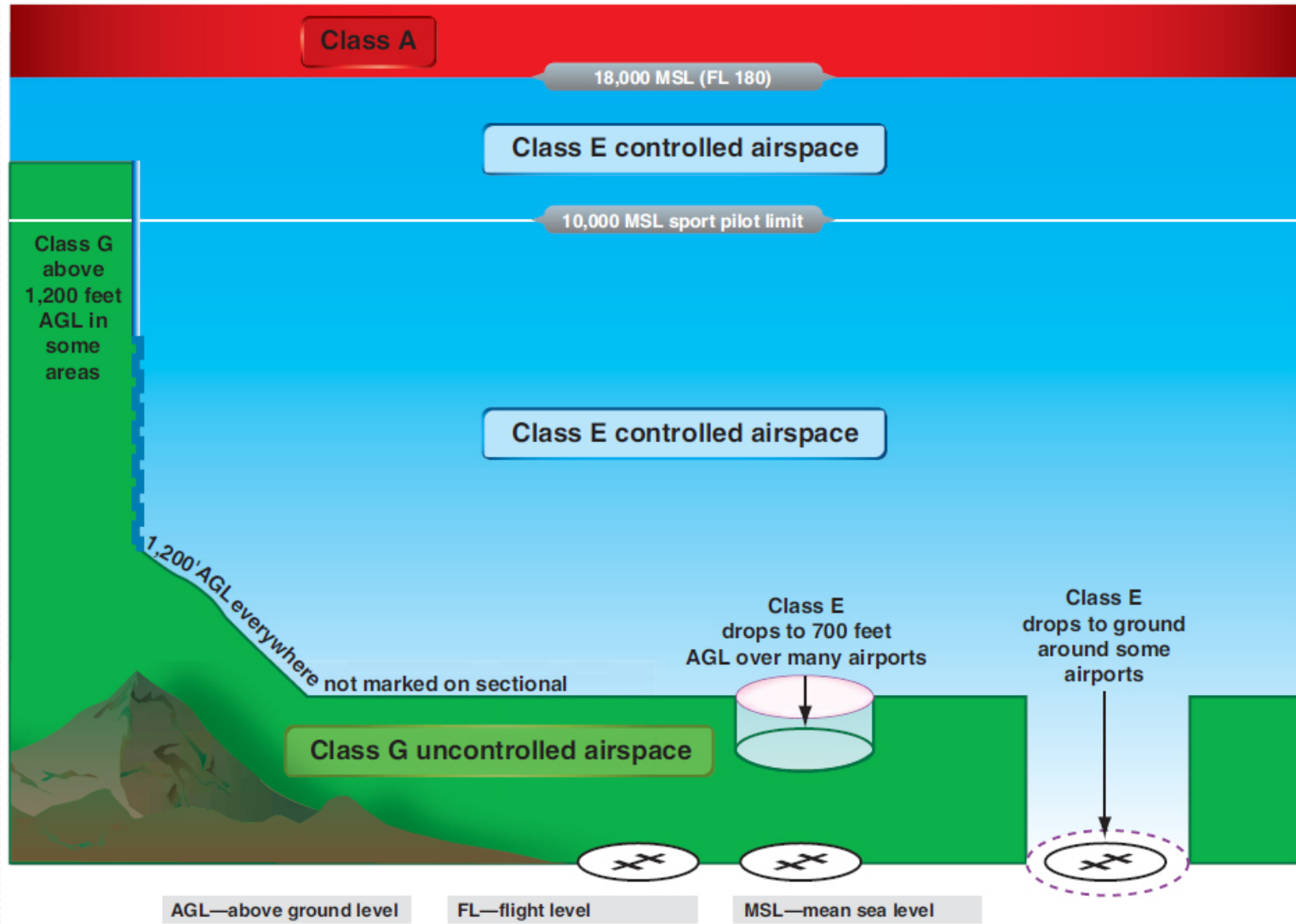
Certificate Number 0838828-20160809-00451

Valerie G. Palazzolo
Valerie G Palazzolo, National Manager, FAA Safety Team

Flight Limitations

- Class G airspace
- Must keep the aircraft in sight (visual line-of-sight)
- Must fly under 400 feet
- Must fly during the day
- Must fly at or below 100 mph
- Must yield right of way to manned aircraft
- Must NOT fly over people
- Must NOT fly from a moving vehicle
- These rules are subject to waiver

Class G Airspace



FAA Certificate of Authorization

- COA is a FAA permit for public agencies to operate
UAS COA case : 2015-ESA-149-COA
- COA 60 days to 1 year processing time
- TDOT has an approved Blanket COA.
- FAA allows for Emergency COAs (e-COAs)
- Or, Petition for Exemption under Section 333

UAS Transportation Applications

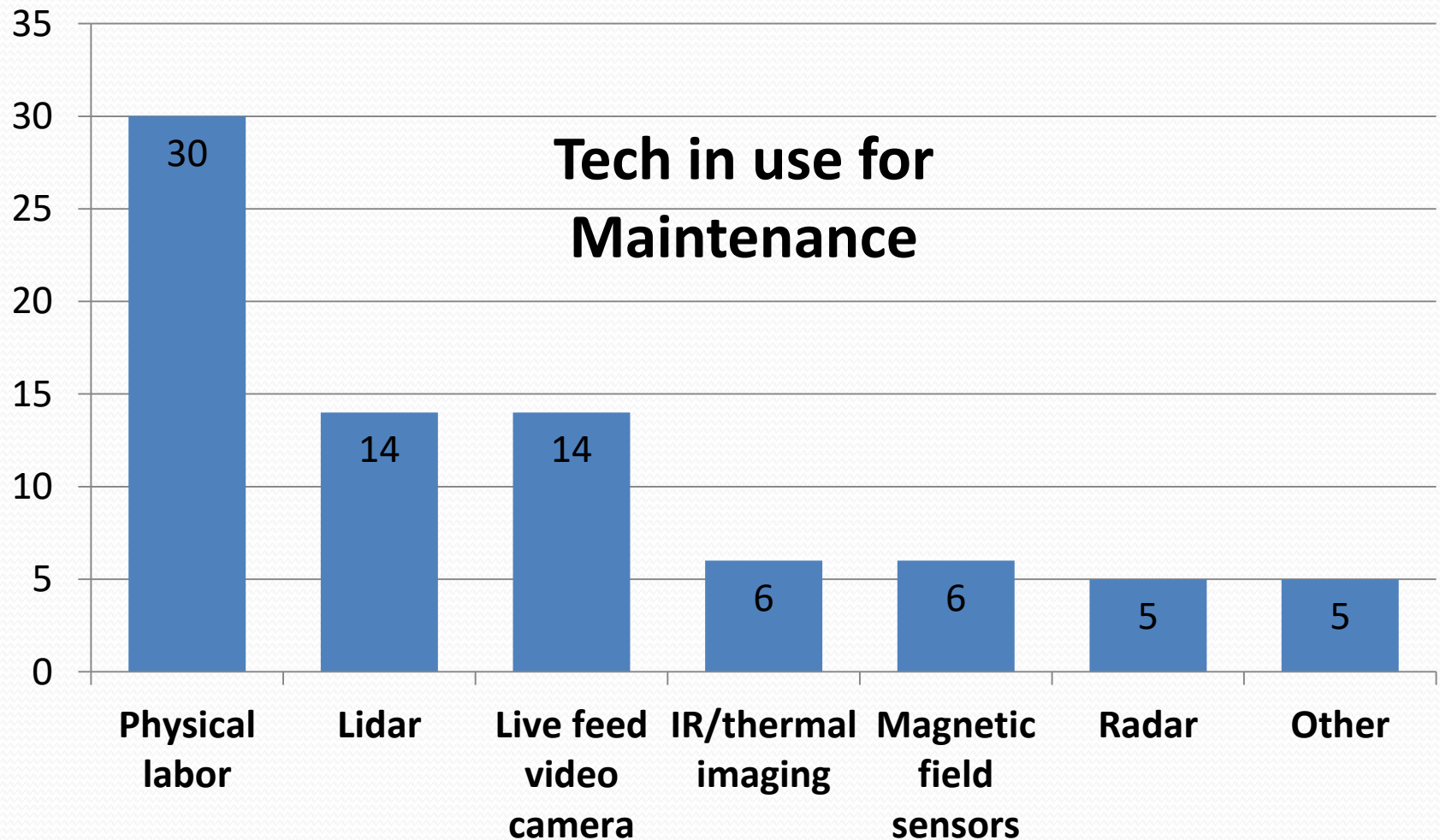


Unmanned Aircraft Survey Results

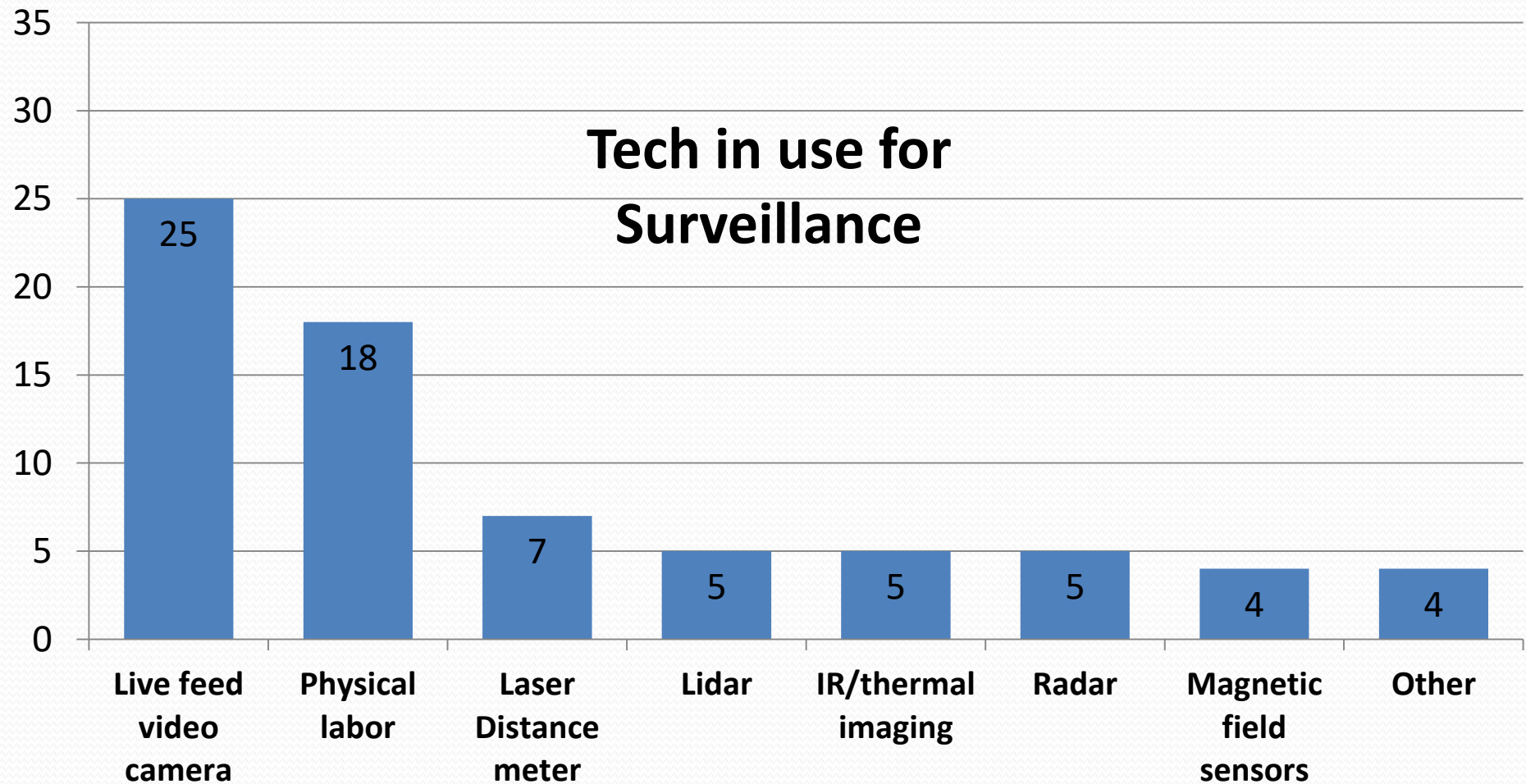
In a survey published on 8/11/15, 31 state transportation offices participated from all across the United States.

- “The survey results provide examples of current technology used at DOT offices as well as the level of Interest of UAS technology”

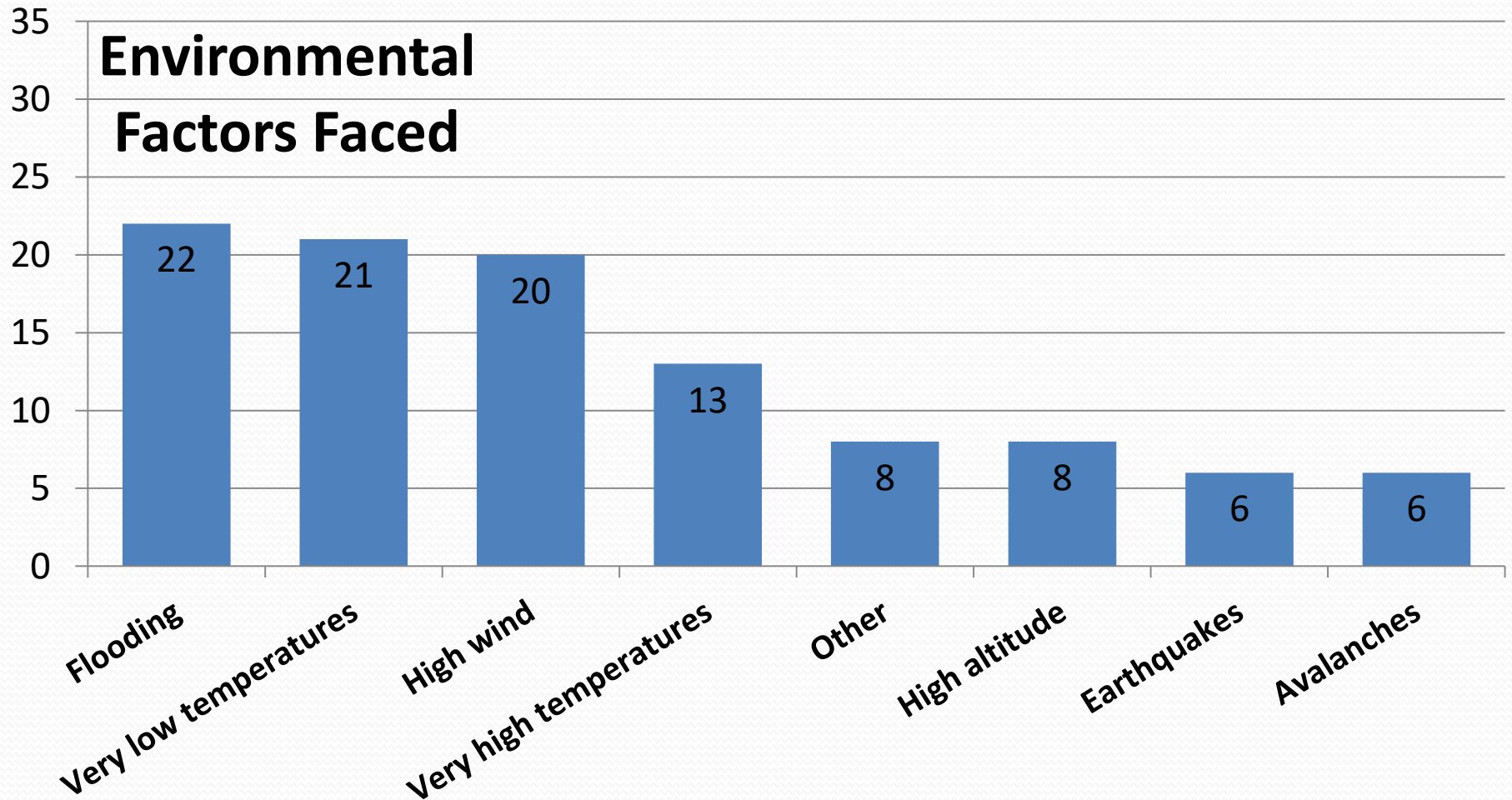
Unmanned Aircraft Survey Results



Unmanned Aircraft Survey Results



Unmanned Aircraft Survey Results



Unmanned Aircraft Survey Results

- Other Environmental Factors Faced:
 - Wildlife
 - Poisonous plants
 - Endangered species protection
 - Freezing cycles
 - Salt air
 - Snow
 - Ice
 - Tornados

Unmanned Aircraft Survey Results

Most Common Application of UAS

Answer	Responses	%
Aerial imaging to support GIS database	15	48%
Evaluating existing road conditions	12	39%
Inspecting defects and cracks of structures, railways, and highways	11	35%
Other	11	35%
Improving safety of labor when working on highways	10	32%
Monitoring the conditions of the freeway	9	29%
Supervision of ongoing roadway construction	7	23%
Surveillance of collisions	7	23%
Tracking vehicle movements at intersections	6	19%
Classifying plant species to be removed for highway constructing	5	16%
Signage inventory	5	16%
Emergency vehicle guidance	4	13%
Monitoring traffic conditions in rural areas	4	13%
Monitoring parking lot utilization	3	10%

Unmanned Aircraft Survey Results

- Other UAS Applications:
 - Surveillance of protected species
 - Estimation of construction material quantities
 - Airfield obstruction inspections
 - Crash reconstruction
 - Inspecting confined spaces

TDOT Interest

- Rock Slides:
 - Investigation and Assessment
 - Monitoring
- Rail Inspection
 - Bridges
 - Limited Access
- Traffic Operations
 - Surveillance
 - Camera Locations
- Radio Tower Inspection
- Bridge Inspection

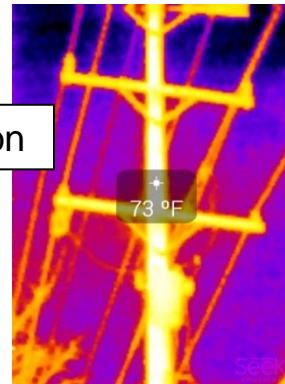
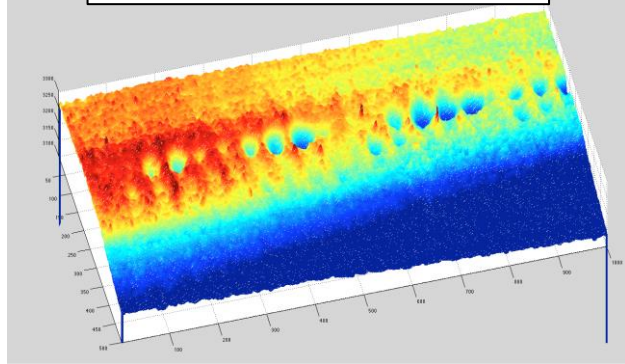
TDOT Interest (Application)

- Mapping
- Photogrammetry
- Surveying LiDAR
- Live Video Streaming
- Videography
- Thermal Imaging (Bridge Inspection)

TDOT Concern

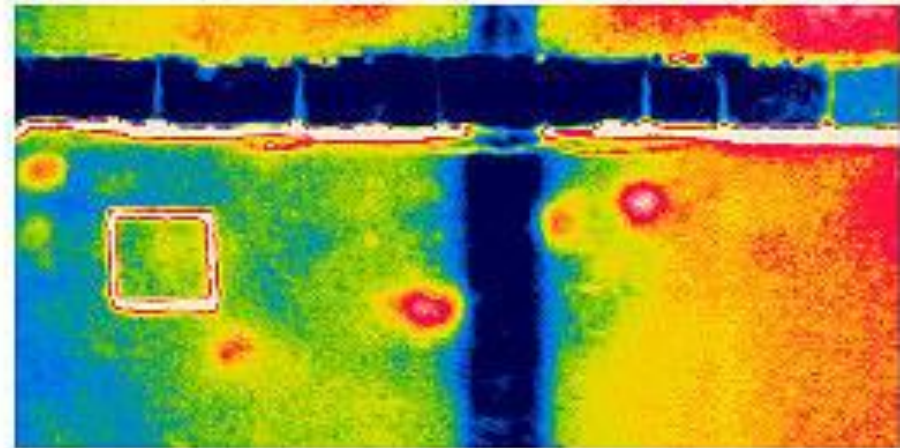
- Liability
- SOP to regulate the use
- In-house/Outsource
- Software Security
- Storage of data

Colin Brooks, Michigan Tech Research Institute



UAS Transportation Applications

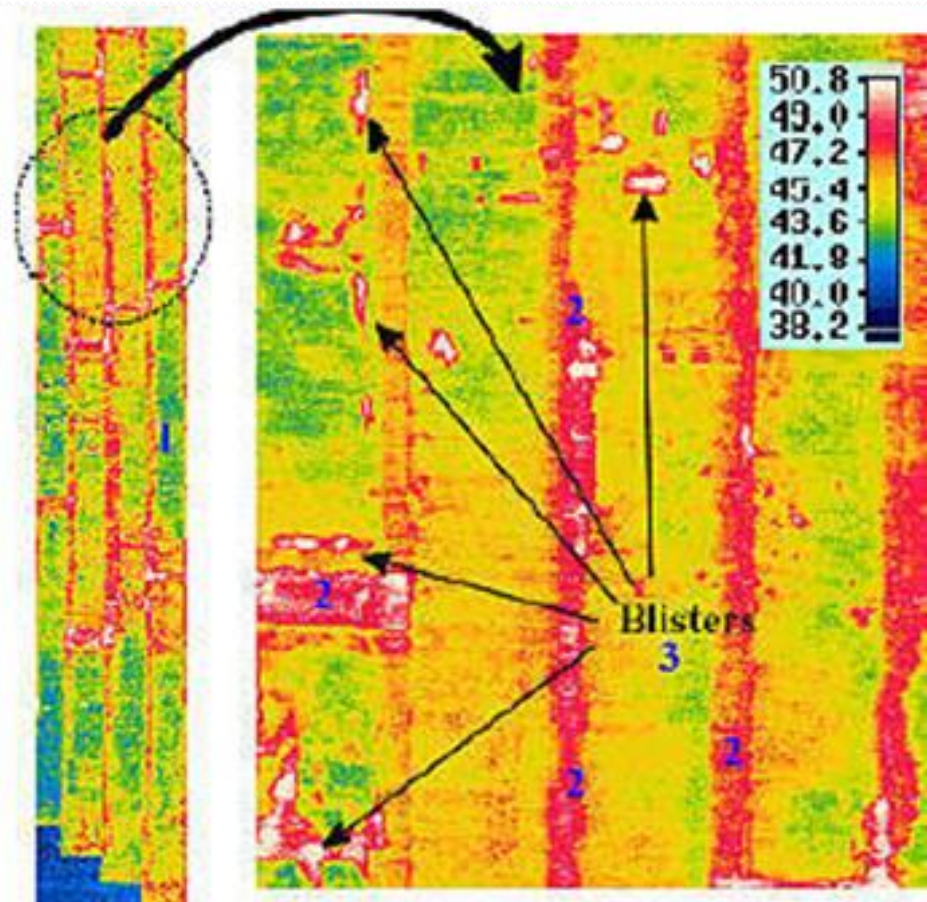
- Bridge and Roadway Non-Destructive Inspection
 - Infrared and Thermal Imaging detecting subsurface conditions.



Colin Brooks, Michigan Tech Research Institute

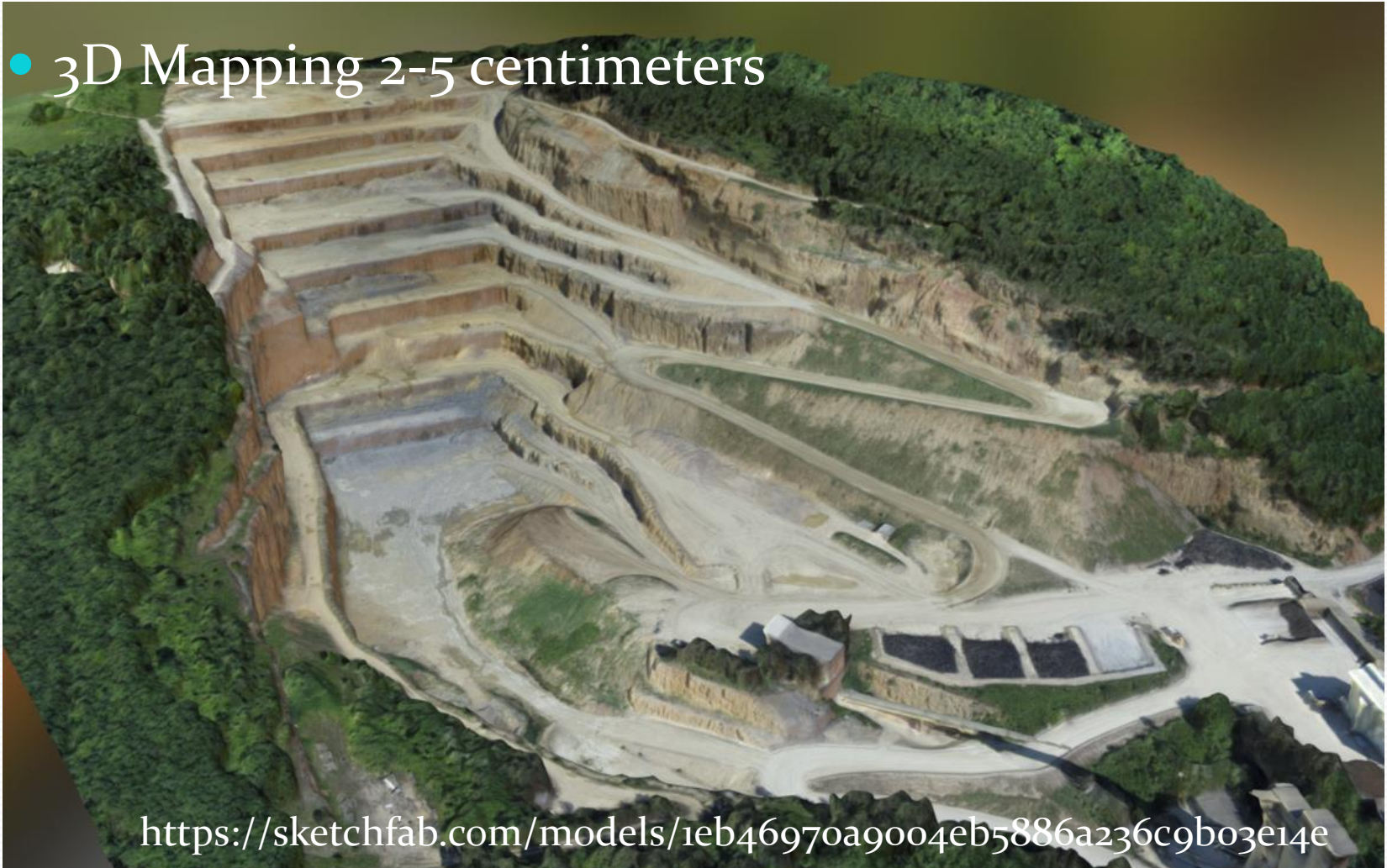
UAS Transportation Applications

- Due to pockets of air, surface temperature varies



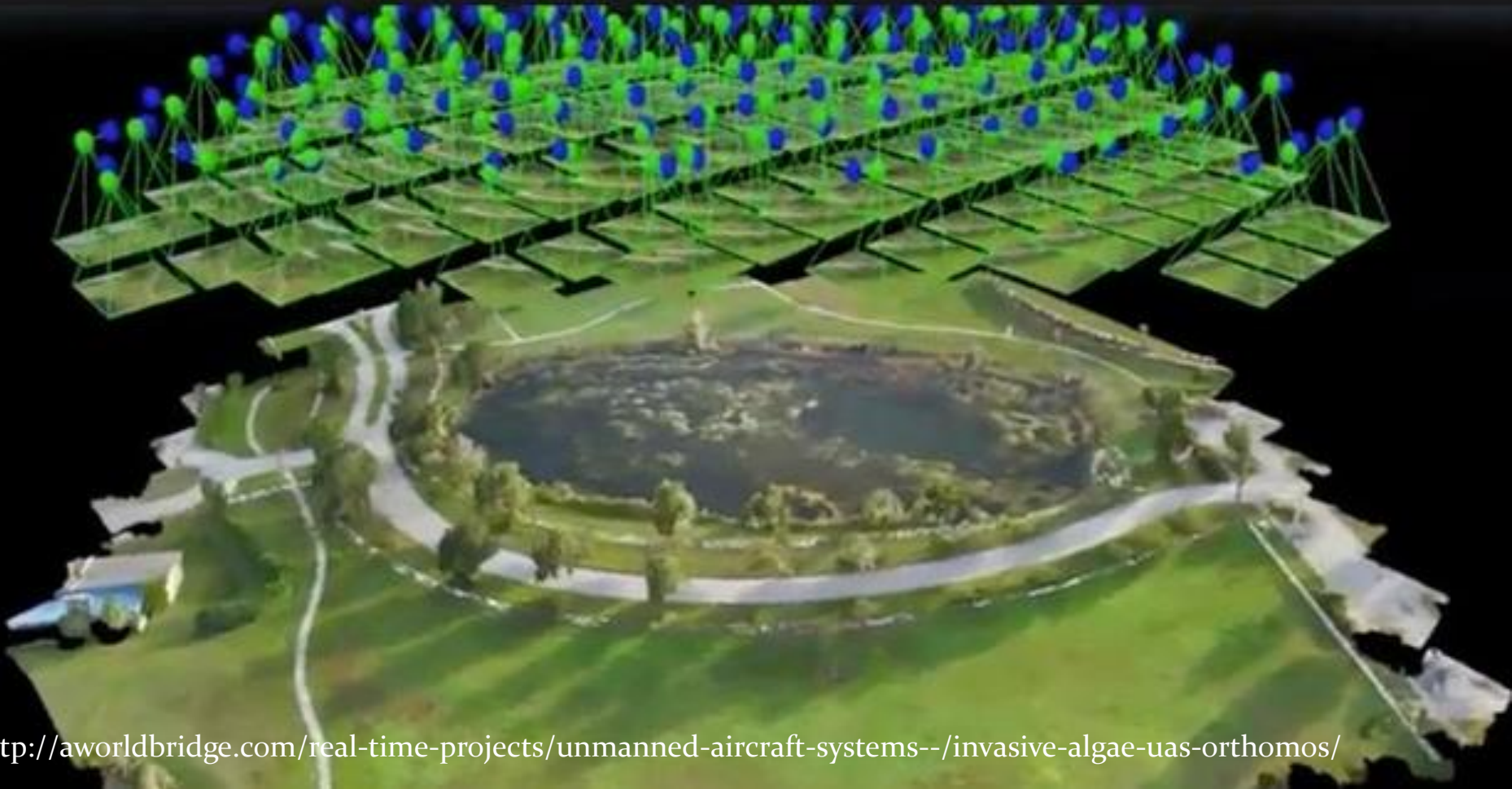
UAS Transportation Applications

- 3D Mapping 2-5 centimeters



<https://sketchfab.com/models/1eb46970a9004eb5886a236c9b03e14e>

UAS Transportation Applications



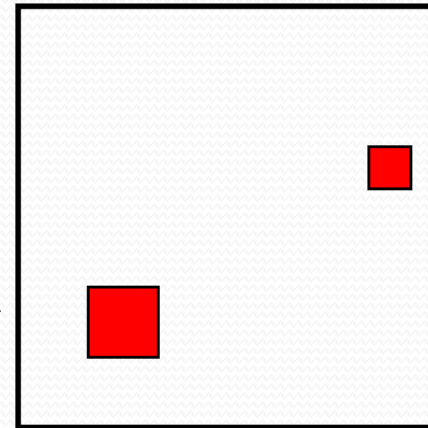
<http://aworldbridge.com/real-time-projects/unmanned-aircraft-systems--/invasive-algae-uas-orthomos/>

Orthophoto, orthoimage

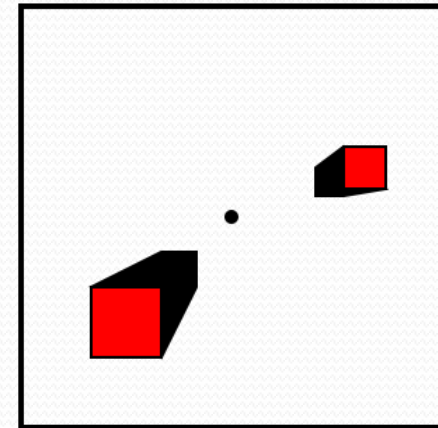
Aerial Photograph
geometrically corrected
"orthorectified" such that the
scale is uniform: the photo has
the same lack of distortion as a
map.

Wikipedia

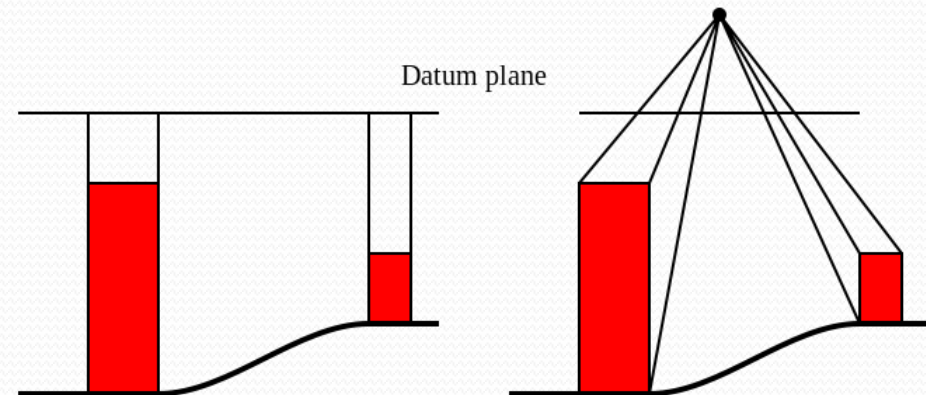
Orthographic view



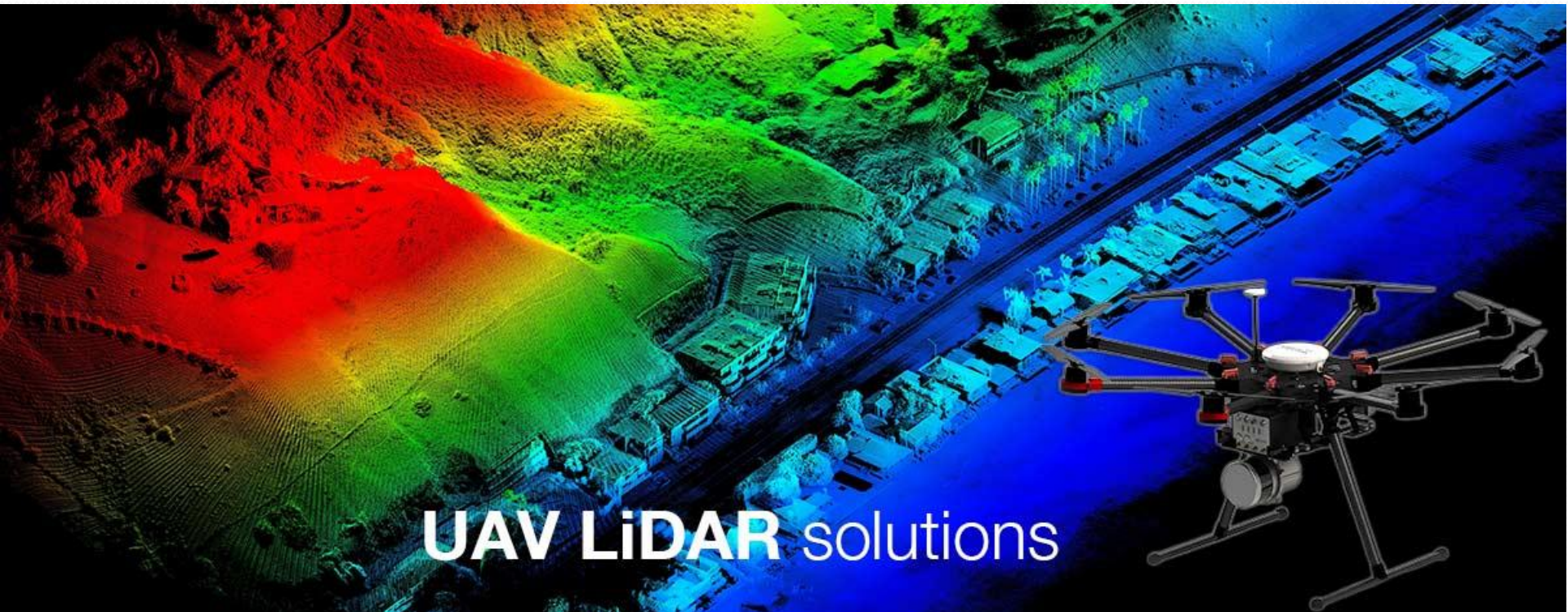
Perspective view



Datum plane



UAS Transportation Applications



<http://www.phoenix-aerial.com/>

UAS Transportation Applications

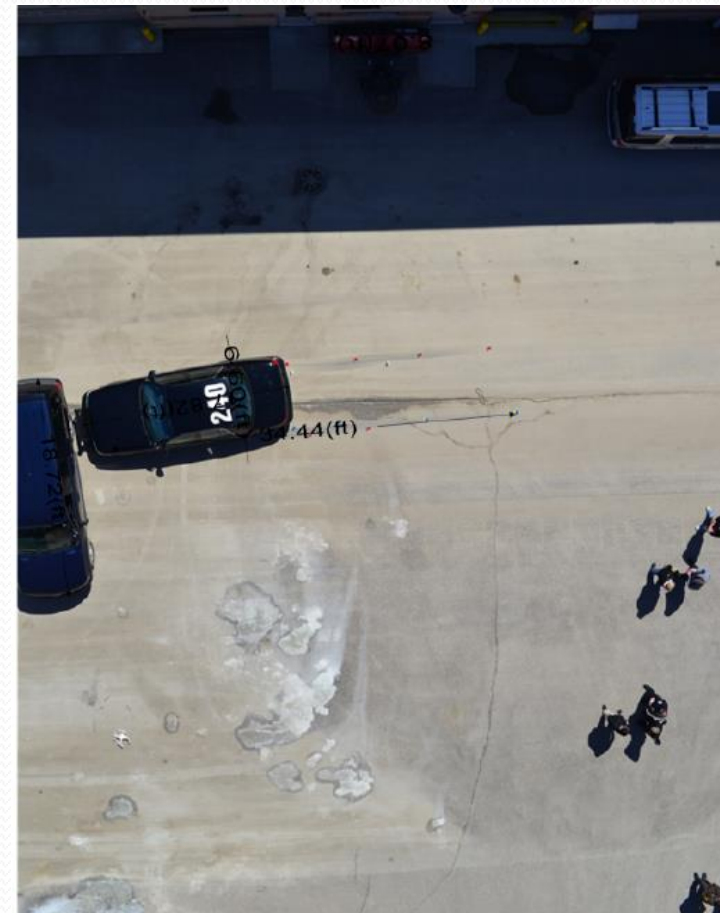


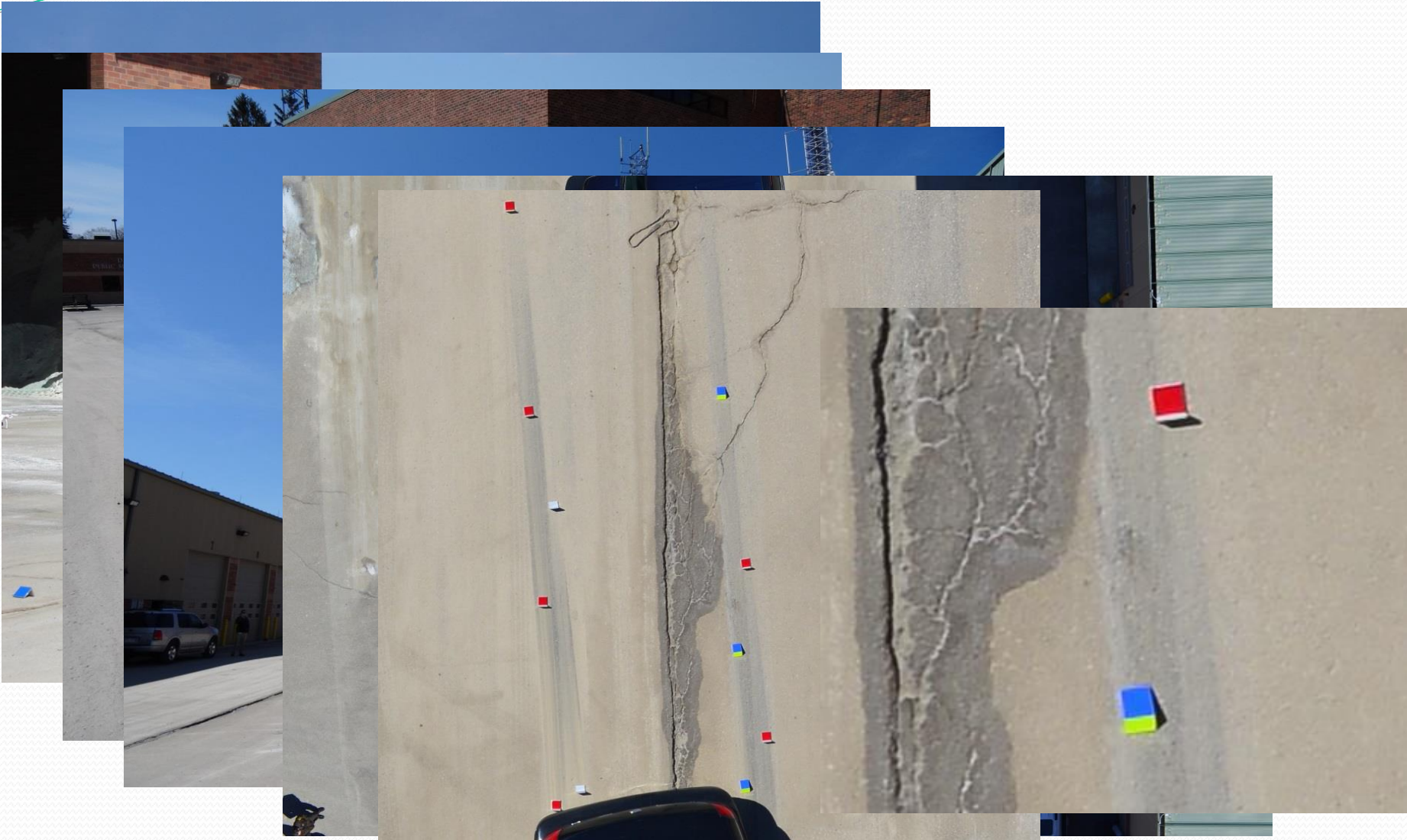
UAS Transportation Applications

- Crash Scene Investigation Research by:

Southeast Oakland County Crash Investigation Team (SOCCIT)

- Using a Hexacopter (\$5,400) and Digital Camera (\$3,800).
- 36 megapixel images





UAS Transportation Applications

- Each crash scene marker was about 20x20 pixels per flat rectangular area, with a pixel equal to 1/11 inch (0.0875 inches) or 2.2 mm.
- *“By using known distances and an approximated drag factor for the road surface, with 15-20 minutes of work, I was able to estimate the speed of the vehicle at 28 mph through imagery captured by the UAV. In training environments, we will test skids at 30 mph, so everything seems to be in line with reality.”*

St. Clair County Officer, Crash scene investigation team

