“Rapid” 3D Bridge Models

Using Drones, 360 Cameras, and Gaussian Splats

Texas Department of Transportation

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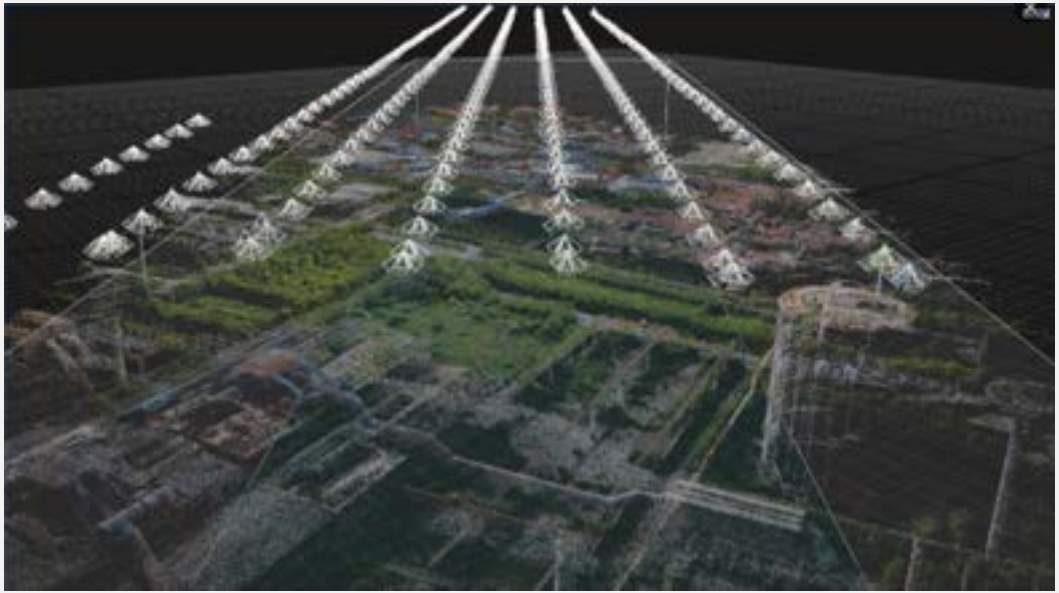
Presenter

Travis Scruggs
GIS Analyst/UAS Pilot

TxDOT – Transportation, Planning, and Programming Division

How do we model reality?



Ortho

3D Scan

c

How do we model reality?

High Resolution – Huge files
Long Collection Times

Low(er) Resolution – Huge files
Short Collection Times

Overview – Photogrammetric Mesh Models vs. 3D Gaussian Splats

	Photogrammetric Mesh Models	3D Gaussian Splats
Geometric Accuracy/ Precision	✓✓✓	✓
Visual Fidelity/Photorealism	✓✓	✓✓✓
Processing Time	✓	✓✓✓
Integration with GIS	✓✓✓	✓

What is a 3d Gaussian Splat?

Gaussian splatting is a volume rendering technique that deals with the direct rendering of volume data without converting the data into surface or line primitives. (wiki)

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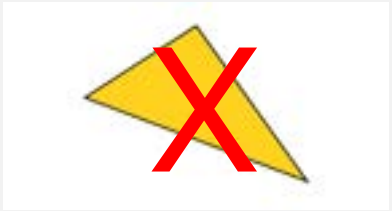
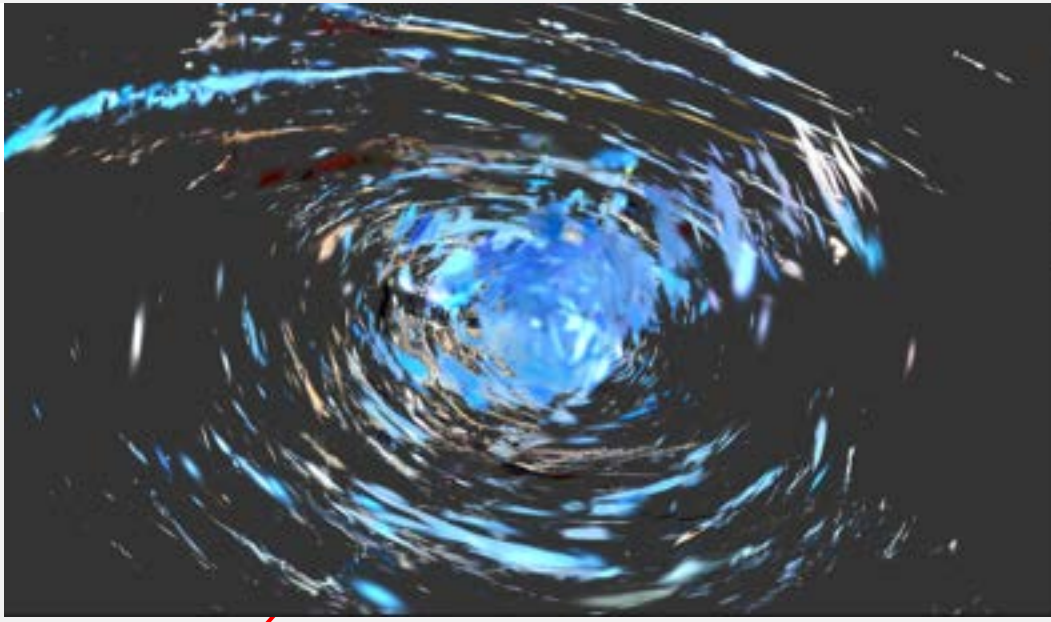




Characteristics:

- **Position**: where it's located (XYZ)
- **Covariance**: how it's stretched/scaled (3x3 matrix)
- **Color**: what color it is (RGB)
- **Alpha**: how transparent it is (α)

Frustums: Pinhole camera viewpoint

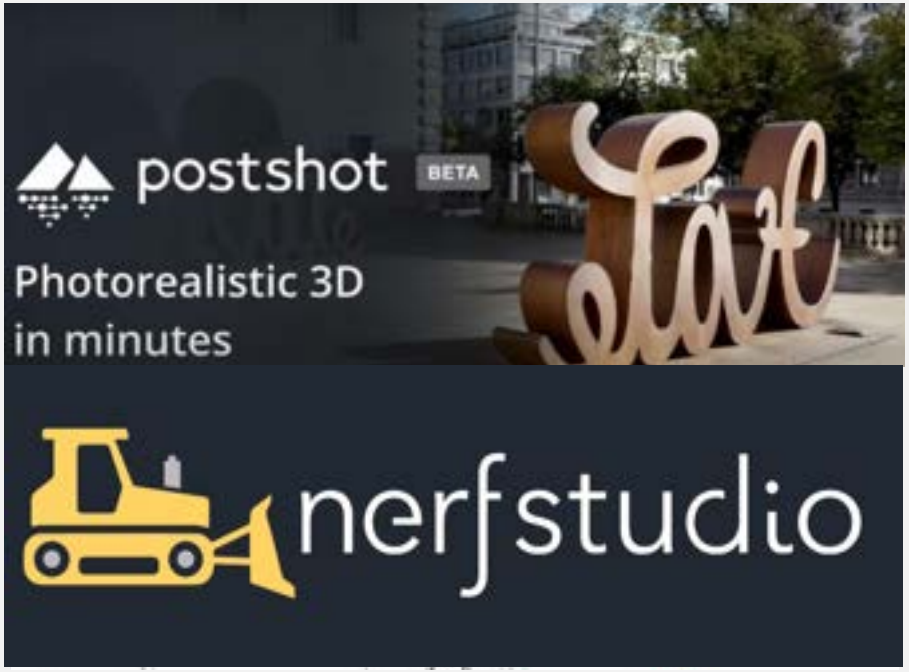
Methods: Tools and Software

Tools:

- **Insta360 x3 (or better)**
- **Computer with plenty of CPUand GPU capability**

Software:

- **COLMap**
- **PostShot and/or NerfStudio**

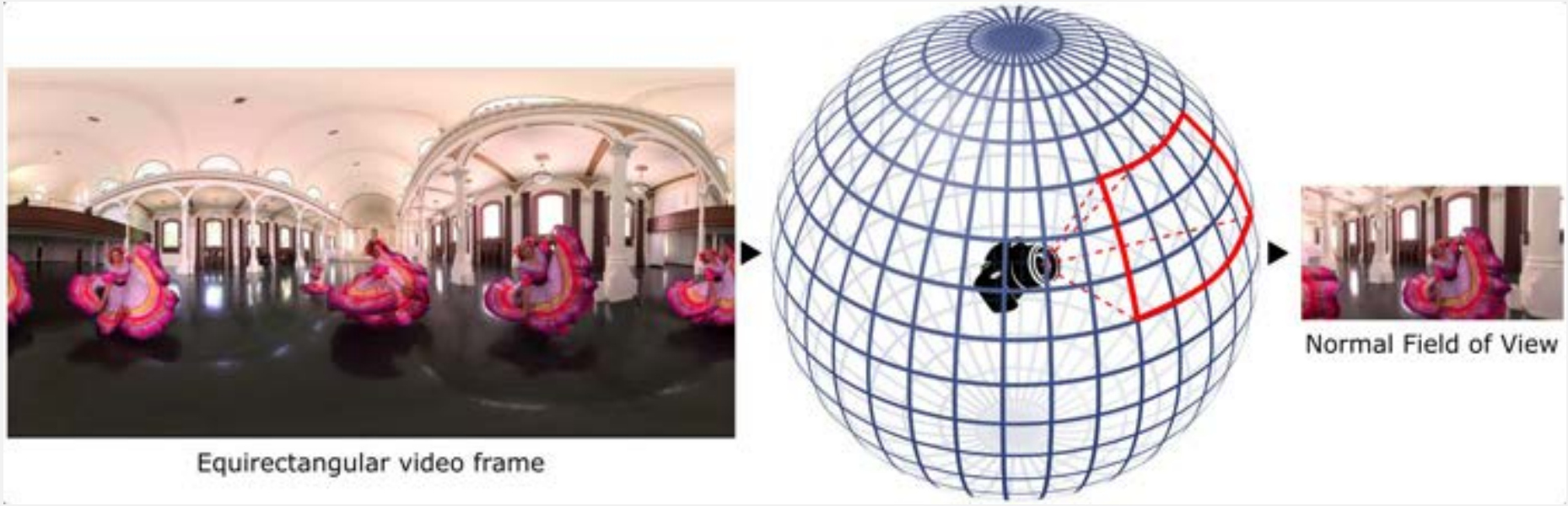


Methods: Video manipulation

360 Spherical > Equirectangular

360 Spherical Equirectangular

Methods: Equirectangular to Frames and Perspectives



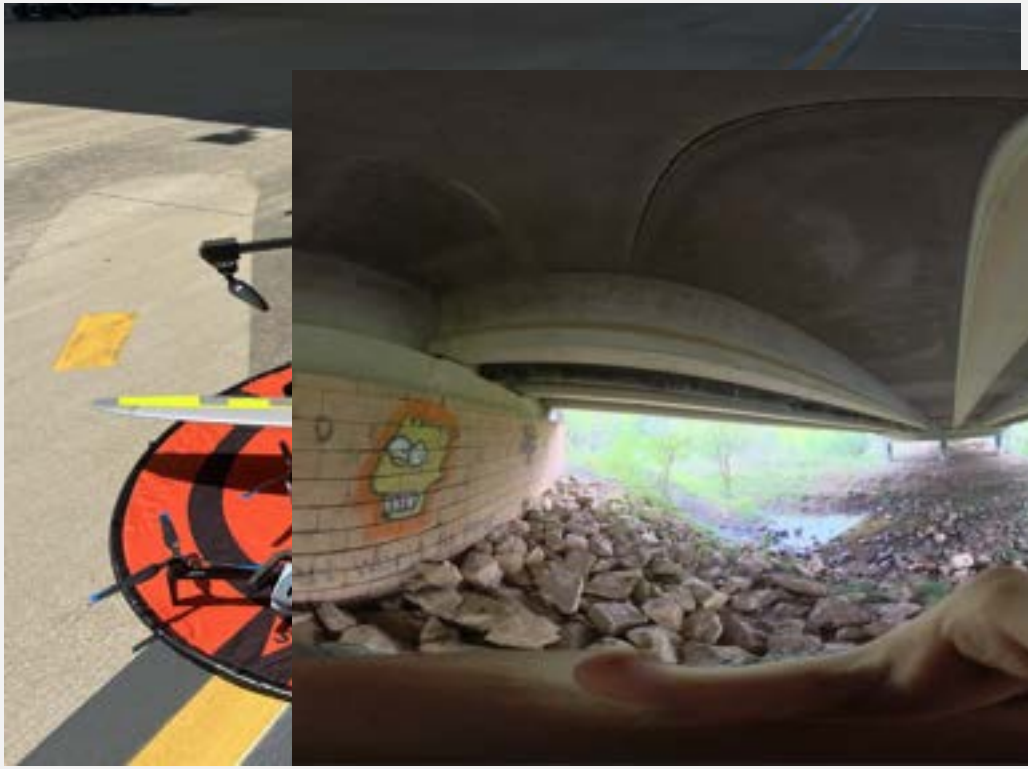
Length in Seconds * 3 = Target number of frames

Each Frame divided into 6/8/14 perspective views

30 seconds video = 1,260 images!

Demo in PostShot, iTwin, and Splatica

WAIT! Where are the Drones??



Liability and time constraints!

The Future

There's so much coming!

- Rapid advancements coming out monthly
- NVIDIA GTC announcments
  - Rapid Splat
  - Multi-GPU processing
  - 3D Gaussian Ray Tracing Project: https://gaussiantracer.github.io/
  - 3D Gaussian UnscentedTransforms Project: https://research.nvidia.com/labs/toronto-ai/3DGUT/
  - Difix3D+ Project: https://research.nvidia.com/labs/toronto-ai/difix3d/
  - 3DGRUT Code (Open Source): https://github.com/nv-tlabs/3dgrut
  - Follow Sonja’s Lab 's Work: https://research.nvidia.com/labs/toronto-ai/

Questions?

Travis Scruggs

Travis.Scruggs@txdot.gov