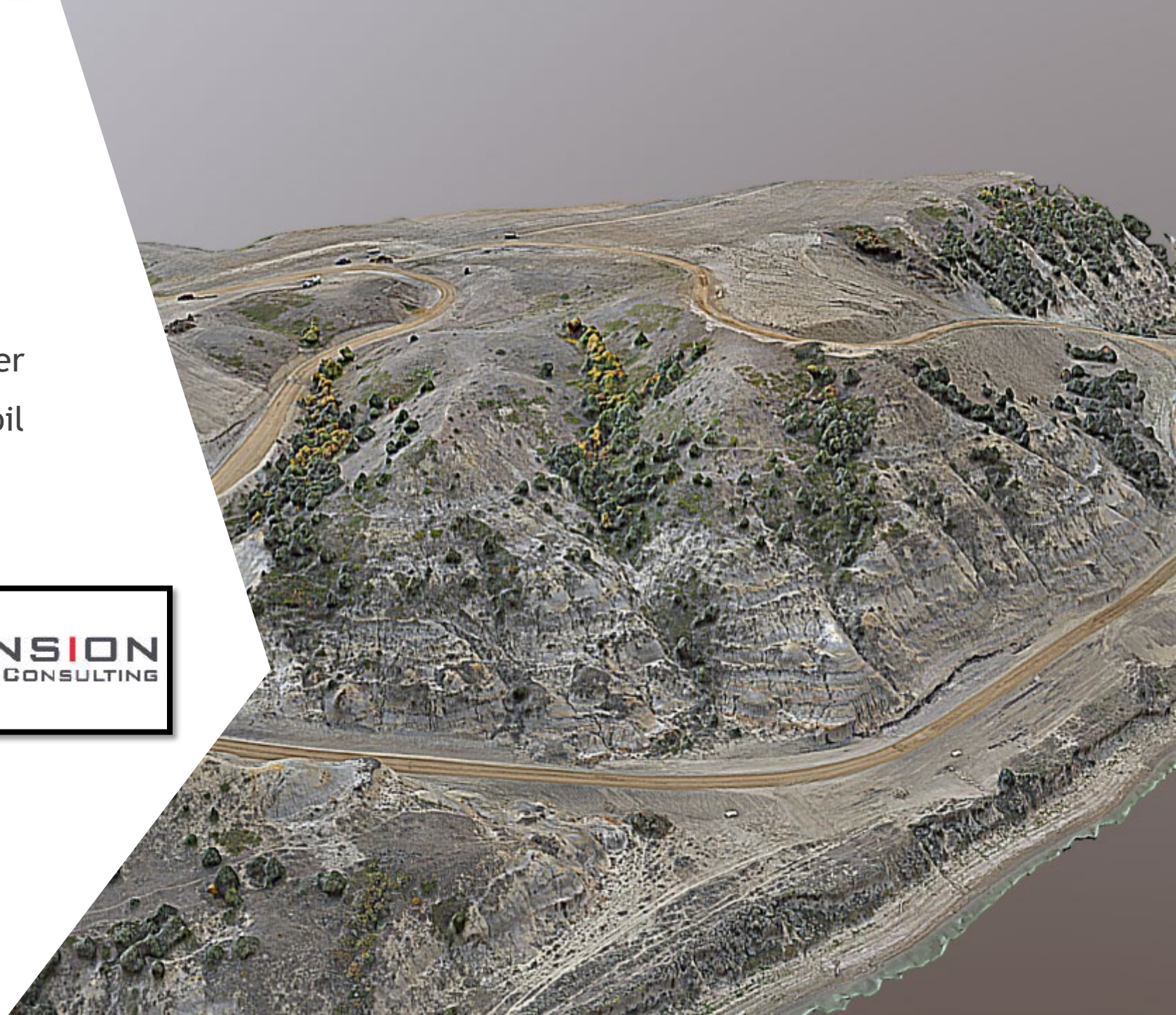
Drone2Map And ArcGIS Enterprise: Building an Oil Field Database

- Thomas Osen
- Geog 596A
- Penn State
- Summer 2020

Thomas Osen

- Professional land surveyor
- Small business owner
- UAV operator and drone mapper
- Work primarily in the Bakken oil formation region



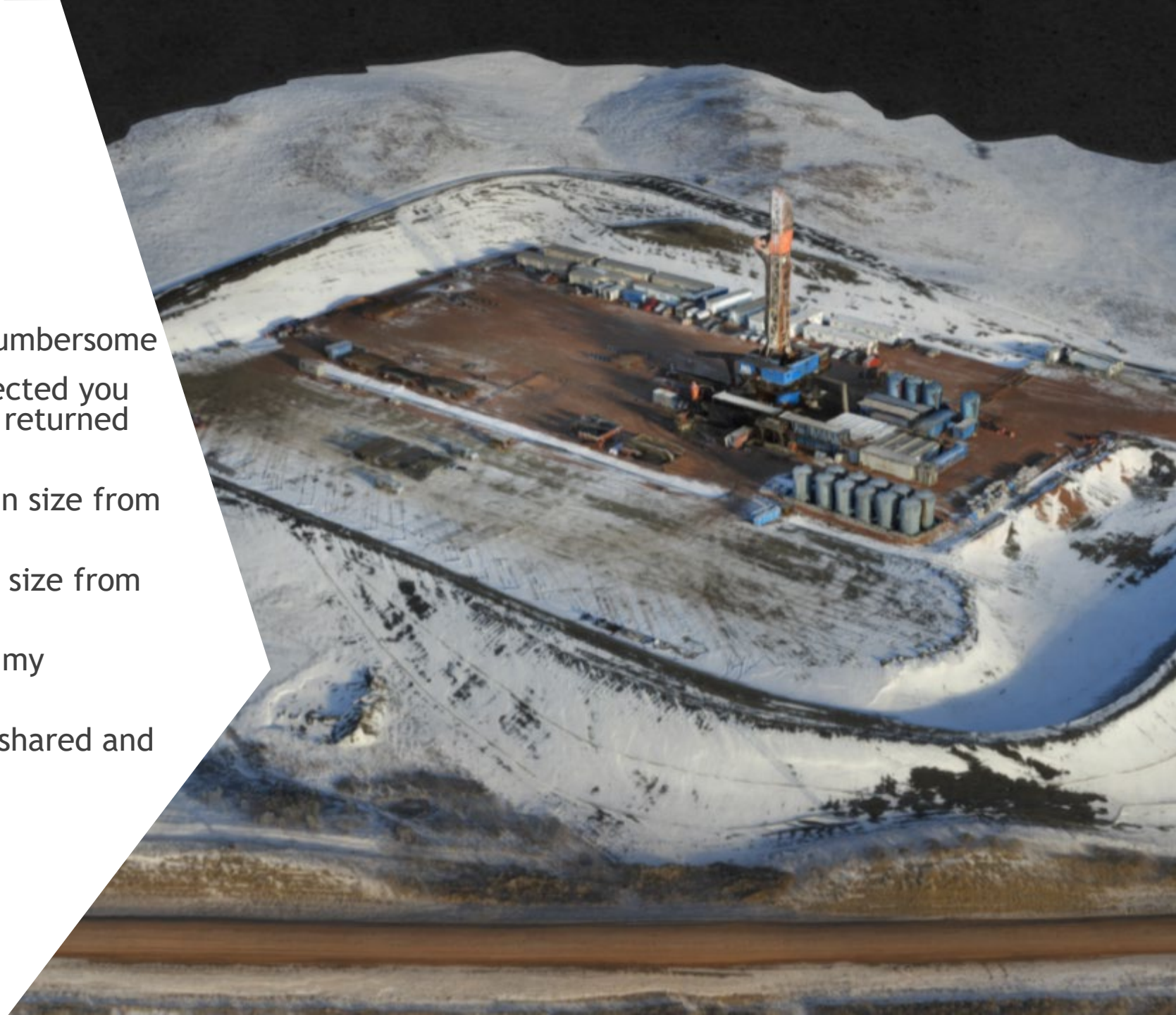
The Challenge

Processed drone data is large and cumbersome

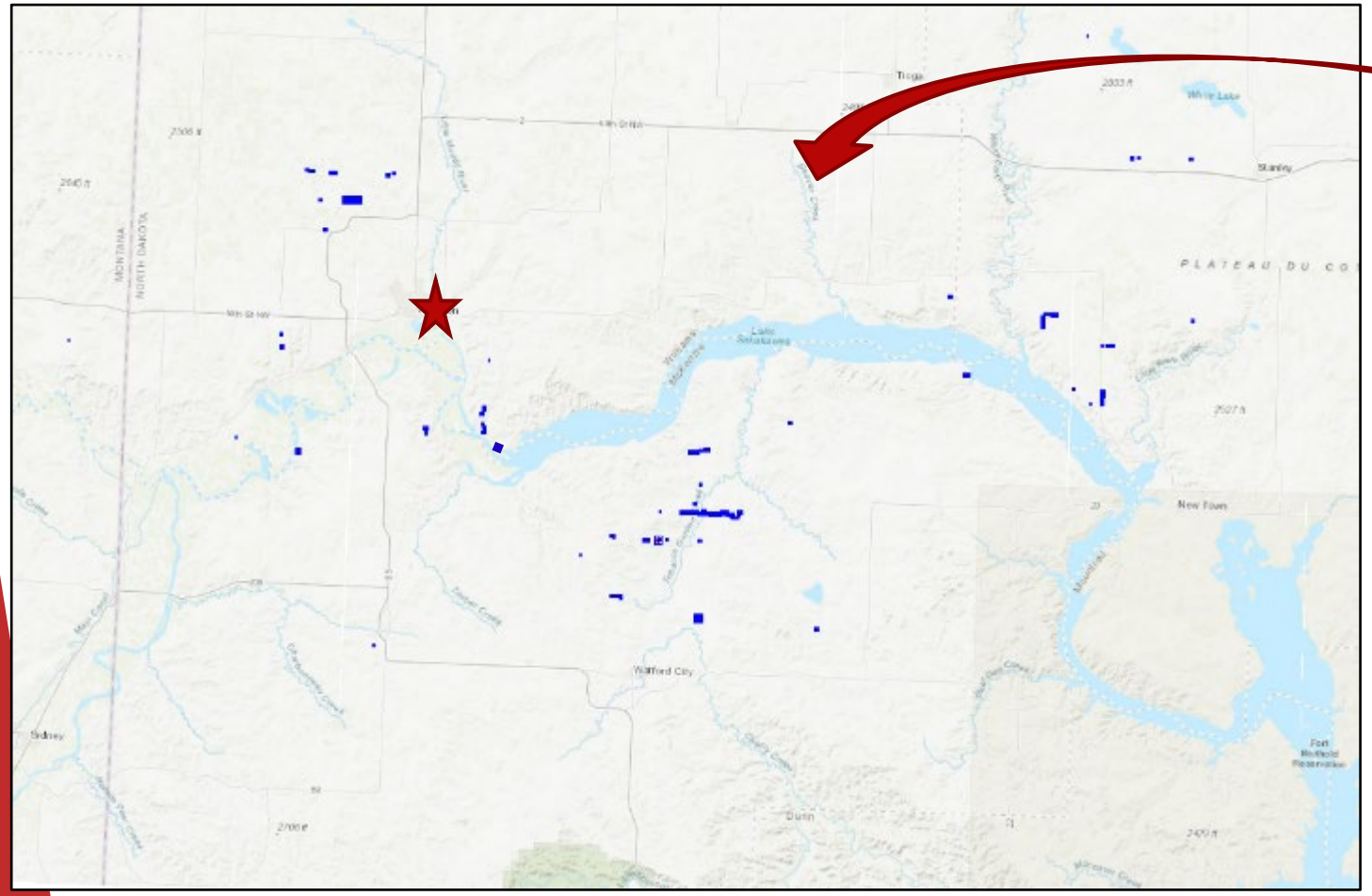
- For every GB of images collected you receive 4 times that in data returned when processed
  - 2D Orthomosaics range in size from 1GB to 6GB
  - 3D Point clouds range in size from 500MB to 4GB

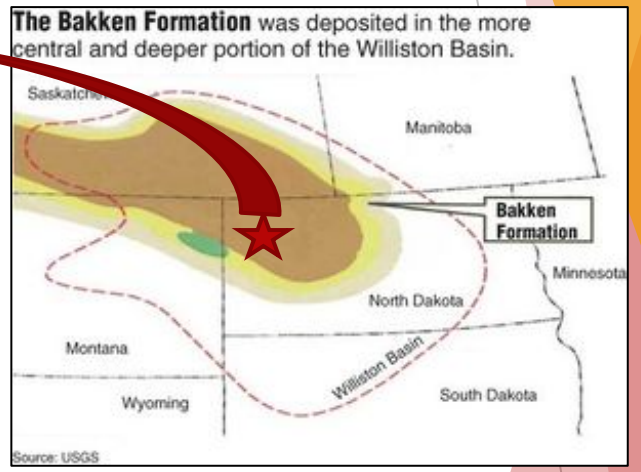
This presents a major challenge for my consulting company

- How can this data be easily shared and utilized by my clients
- Clients often out of state



Project Region:
Williston ND aka. Bakken Oil Formation





The Solution

Bridging the Gap

- Process drone imagery into respective 2D and 3D products
- Upload them into a server-based system
- Produce an interactive map with the data

With ***Drone2Map*** can easily share results through ***ArcGIS Enterprise Portal***

- Team effort from Esri and Pix4D
- No need for everyone to have an advanced computer
- Share 3D models, DSM/DTM, Contours and 2D orthomosaics of drone data utilizing the Portal and Webapps
- Safely store and access at any time and even download data

ArcGIS. (2016) *Introducing Drone2Map for ArcGIS*. [image] Retrieved on July 10, 2020 from https://www.youtube.com/watch?v=fbNDD35rxyQ

ArcGIS. (2019) *Start Your Web GIS Journey with ArcGIS Enterprise*. [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=TEI0jWgc_f8

Drone Analyst. (2020*) Is Esri's Drone2Map a Game Changer?* June 17, 2020 from https://droneanalyst.com/2016/07/25/is-esris-drone2map-a-game-changer

Drone2Map for ArcGIS Help. (2020) *What is Drone2Map for ArcGIS?* Retrieved June 14, 2020 from https://doc.arcgis.com/en/drone2map/get-started/what-is-drone2map.htm

Esri Events. (2016) *ArcGIS Apps: Drone2Map for ArcGIS: Bring Drone Imagery into ArcGIS.* [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=63qAQJZGab8

Esri Events. (2019) *ArcGIS Enterprise: Managing and Serving Imagery in the Cloud using ArcGIS Image Server.* [Video] https://www.youtube.com/watch?v=OuGYKPlVRuc

Esri Events. (2020) *ArcGIS Enterprise: An Introduction.* [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=Gw9_nOM_jYQ

Why Drone2Map?

Drone2Map Features

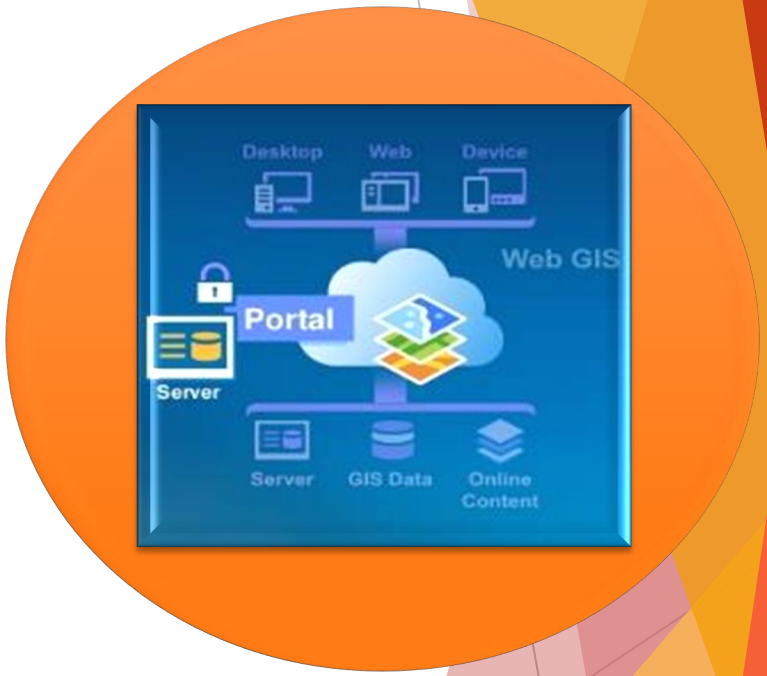
- Fully integrated Pix4D software
- Batch processing
- Analytical tools built inside
- Inspections from imagery
- Produce full array of 2D and 3D products
- Import other data into Drone2Map
- Share 2D and 3D data via the ArcGIS Enterprise platform

Esri UK & Ireland. (2020) *Drone2Map for ArcGIS.* June 15, 2020 from https://www.esriuk.com/en-gb/arcgis/products/drone2map/overview

The Process

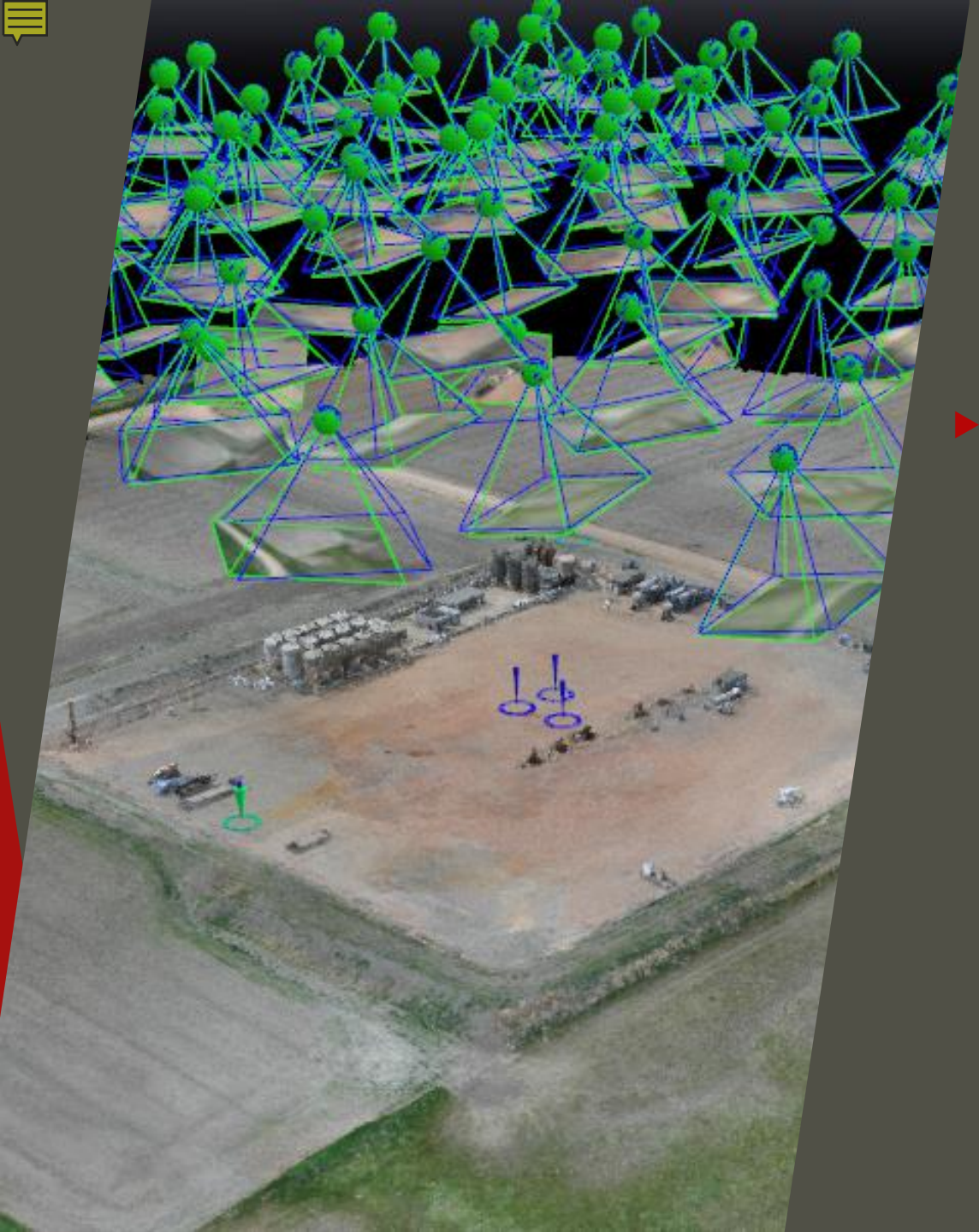
- 1. Imagery is collected with a *senseFly eBee RTK+* fixed wing drone of desired well sites

- 2. Process the data through Drone2Map to make 3D models, point clouds and 2D orthomosaics



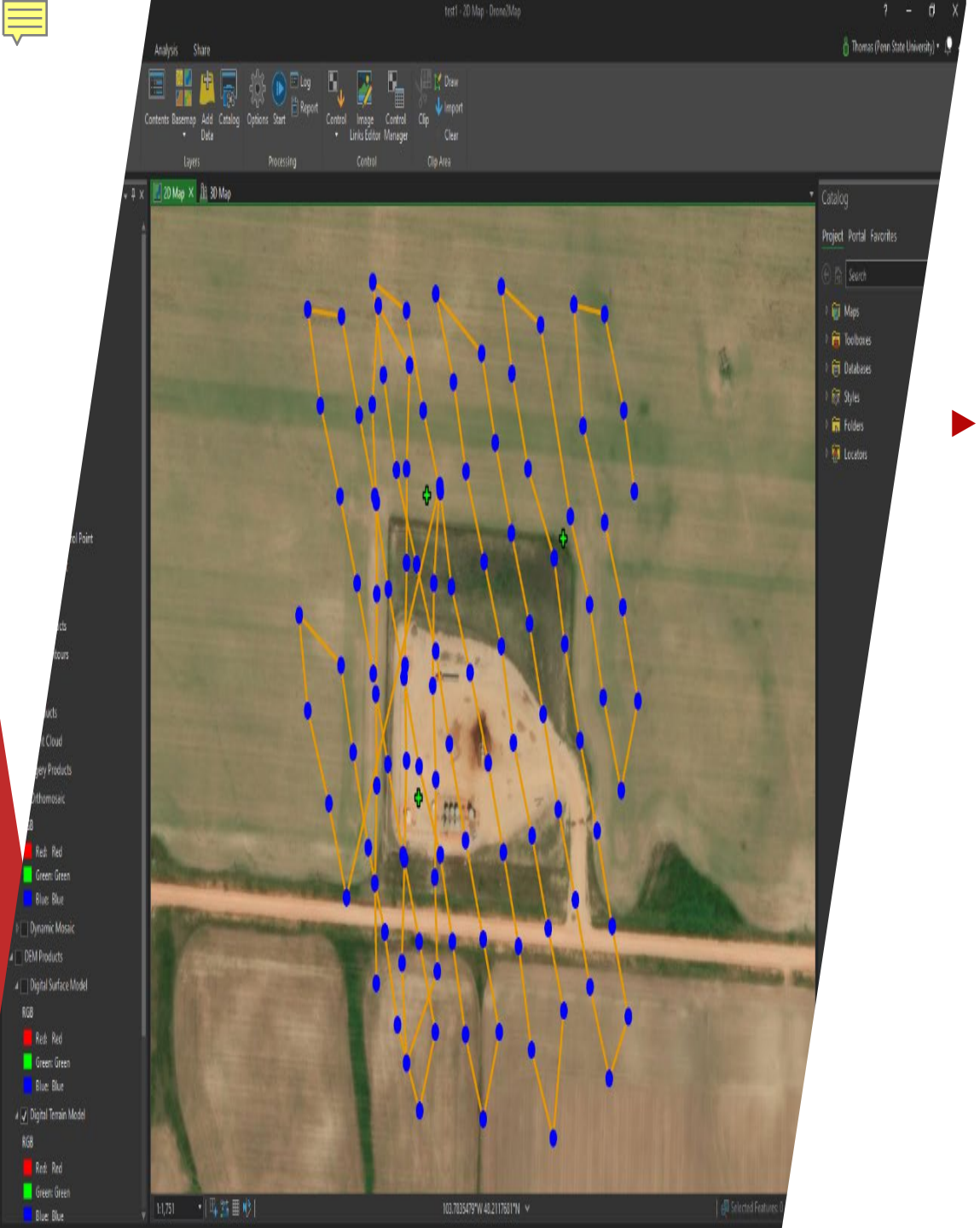
- 3. Export processed drone data to the ArcGIS Enterprise Portal for easy access to drone imagery deliverables

ArcGIS. (2016) *Introducing Drone2Map for ArcGIS.* [image] Retrieved on July 10, 2020 from https://www.youtube.com/watch?v=fbNDD35rxyQ.com.ezaccess.libraries.psu.edu/docview/1879872444?accountid=13158
Esri UK. (2016) Architecting the ArcGIS Platform. [image] Retrieved on July 8, 2020 from https://www.slideshare.net/Esri_UK/architecting-the-arcgis-platform
senseFly. (2020) eBee Rtk+. [Image] retrieved on June 1 2020 from https://www.sensefly.com/drone/ebee-plus-survey-drone/



Drone Imagery Collected

- All the drone data was collected with a *senseFly* RTK+ fixed wing drone
  - Flown in an GPS RTK
  - A minimum of 3 aerial targets
  - Flights are flown with 80% overlap perpendicular to the wind when possible



Drone2Map Process

- Drone2Map has an interface like ArcGIS Pro with drone related analytical tools
  - Upload a drone imagery collection and tag aerial target ground control points in the images
  - Process the images though the 3-step process:
    - Initial Processing
    - 2D Products
    - 3D Products

Drone2Map Results

- 3D point clouds
- 3D mesh
- Hillshaded DSM/DTM
- Contours

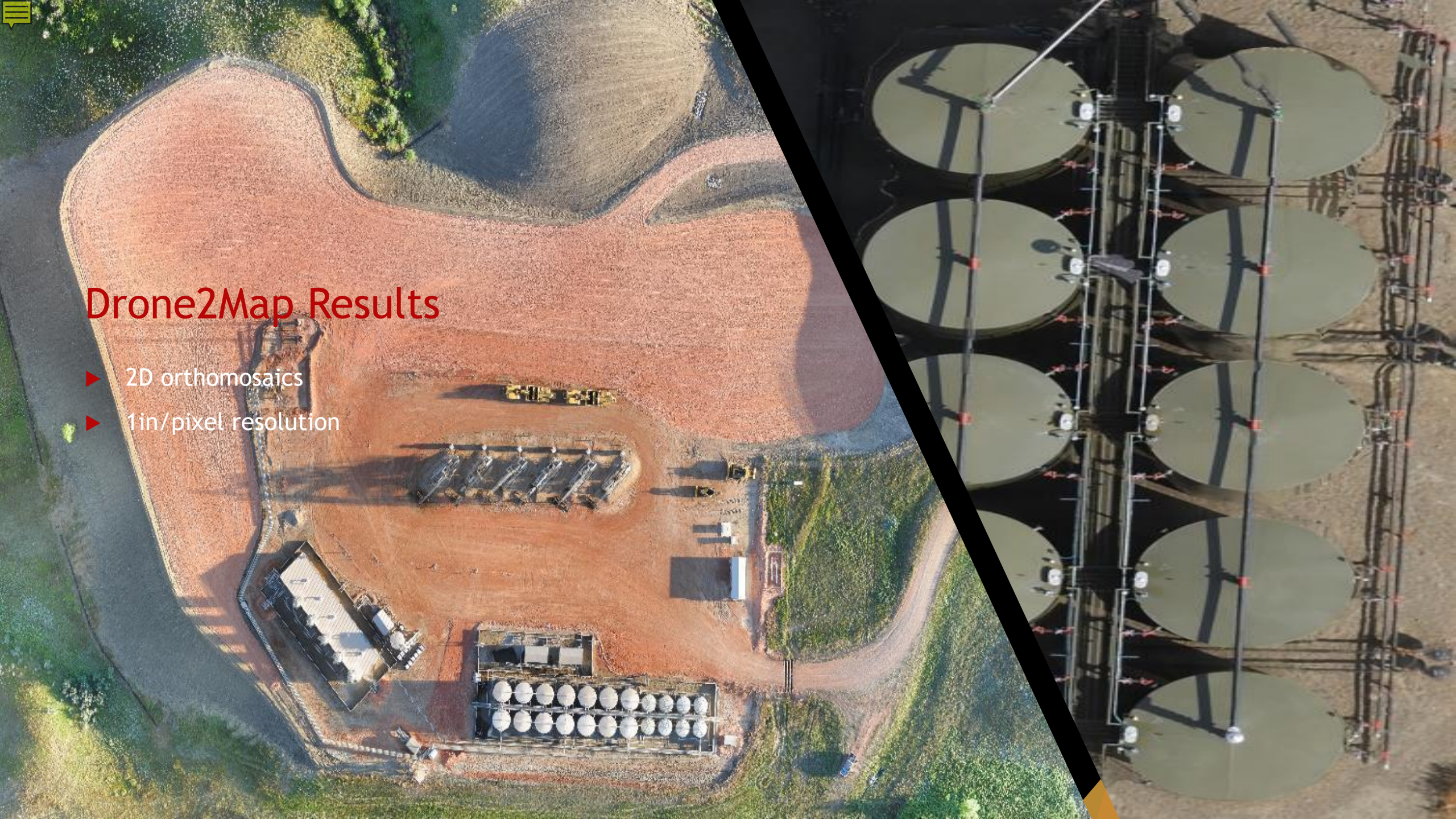
Hillshaded DSM/DTM and Contours

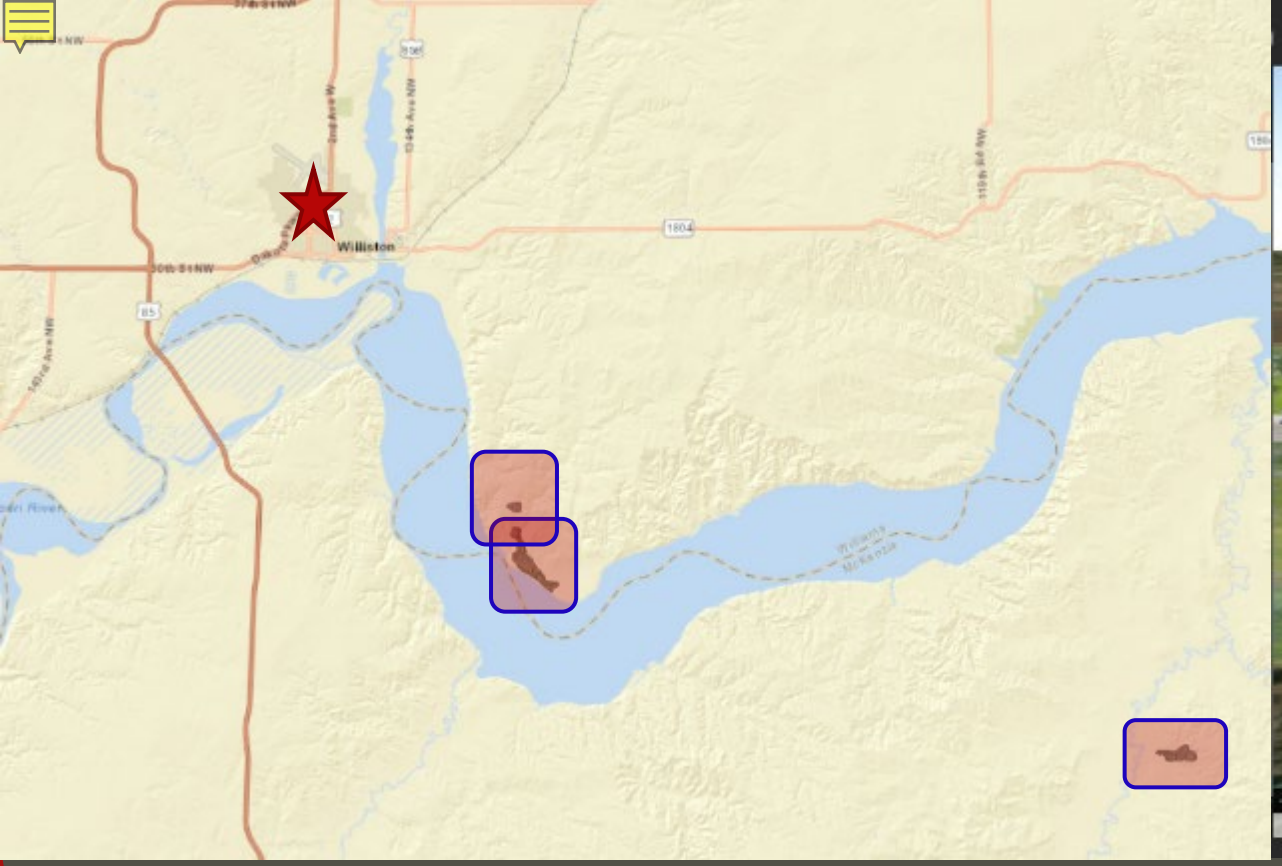
3D point clouds

3D mesh

Drone2Map Results

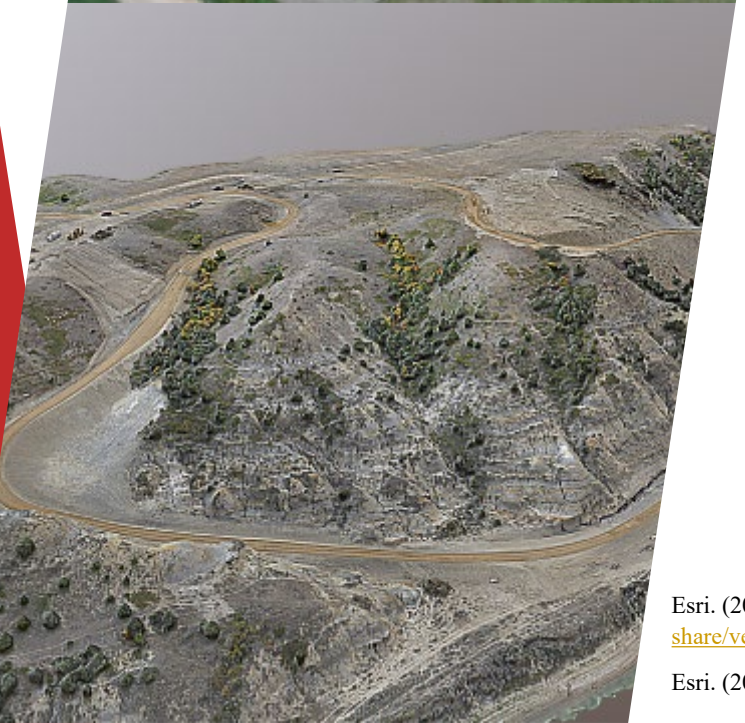
- 2D orthomosaics
- 1in/pixel resolution





ArcGIS Enterprise

- Upload imagery data
- Zoom into area of interest
- Web Apps



Limitations

Drone2Map

- Major analytics need to have Drone2Map license or other GIS advanced software
- Need a powerful computer to make efficient
- ArcGIS software knowledge is helpful

ArcGIS Enterprise

- Limited Analytics of data on the Server Platform
- Vertical ***meters*** if 3D products and point clouds are to be uploaded

Esri. (2019) *Drone2Map for ArcGIS (v1.3x Archive).* Retrieved on July 15, 2020 from https://doc.arcgis.com/en/drone2map/1.3/process-and-share/vertical-reference.htm#GUID-9B2E8B9C-21B9-44A5-96B2-BDD7546C02F9

Esri. (2019) *Portal ArcGIS.* Retrieved on July 15, 2020 from https://enterprise.arcgis.com/en/portal/latest/use/cut-and-fill-volume-calculation.htm

Schedule

Process Data

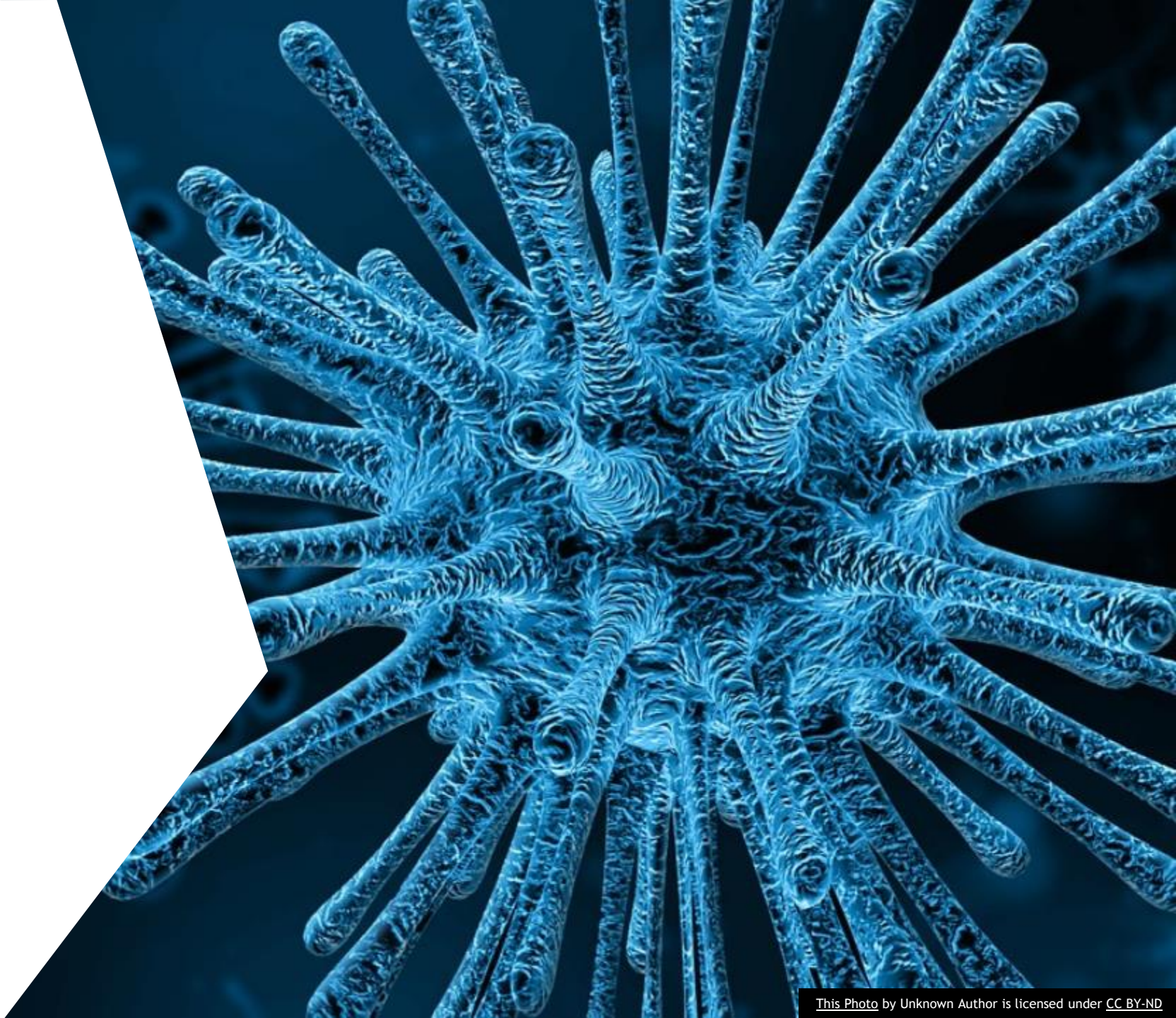
- August 1st through November 15th process all existing data and import into ArcGIS Enterprise

Review and Analyze

- November 15th to December 1st analyze processes and results and develop final presentation

Final Presentation

- December 7th Through 15th



Drone2Map & ArcGIS Enterprise Recap

- Power of Pix4d and Esri
- Data stored safely and securely
- Historical record of data
- Increased productivity
- Improve efficiency
- Cost savings
- Customizable Web Apps
- Easily share data

Thank you for your time!

I really appreciate your questions and feedback?!

Special Thanks:

- OASIS PETROLEUM
- Damon Jorgensen
- Sara Bosshard
- Neto Garcia

References

1. 50^{O} North. (2018). *Review: UAV Image Processing Software*. June 30, 2020 from http://www.50northspatial.org/uav-image-processing-software-photogrammetry/
2. ArcGIS. (2016) *Introducing Drone2Map for ArcGIS*. [image] Retrieved on July 10, 2020 from https://www.youtube.com/watch?v=fbNDD35rxyQ
3. ArcGIS. (2019) *Start Your Web GIS Journey with ArcGIS Enterprise*. [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=TEI0jWgc_f8
4. Drone Analyst. (2020*) Is Esri's Drone2Map a Game Changer?* June 17, 2020 from https://droneanalyst.com/2016/07/25/is-esris-drone2map-a-game-changer
5. Drone2Map for ArcGIS Help. (2020) *What is Drone2Map for ArcGIS?* Retrieved June 14, 2020 from https://doc.arcgis.com/en/drone2map/get-started/what-is-drone2map.htm
6. Esri. (2019) Portal for ArcGIS. Retrieved on July 14, 2020 from https://enterprise.arcgis.com/en/portal/latest/administer/windows/what-is-portal-for-arcgis-.htm
7. Esri. (2019) *Drone2Map for ArcGIS (v1.3x Archive).* Retrieved on July 15, 2020 from https://doc.arcgis.com/en/drone2map/1.3/process-and-share/vertical-reference.htm#GUID-9B2E8B9C-21B9-44A5-96B2-BDD7546C02F9
8. Esri. (2019) *Portal ArcGIS.* Retrieved on July 15, 2020 from https://enterprise.arcgis.com/en/portal/latest/use/cut-and-fill-volume-calculation.htm
9. Esri Events. (2016) *ArcGIS Apps: Drone2Map for ArcGIS: Bring Drone Imagery into ArcGIS.* [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=63qAQJZGab8
10. Esri Events. (2019) *ArcGIS Enterprise: Managing and Serving Imagery in the Cloud using ArcGIS Image Server.* [Video] https://www.youtube.com/watch?v=OuGYKFlVRuc
11. Esri Events. (2020) *ArcGIS Enterprise: An Introduction.* [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=Gw9_pOM_jYQ
12. Esri rolls out new image platform bundles (2017). *Entertainment Close - Up*. Retrieved on May 21, 2020 from http://ezaccess.libraries.psu.edu/login?url=https://search-proquest-com.ezaccess.libraries.psu.edu/docview/1879872444?accountid=13158
13. Esri UK. (2016) Architecting the ArcGIS Platform. [image] Retrieved on July 8, 2020 from https://www.slideshare.net/Esri_UK/architecting-the-arcgis-platform
14. Esri UK & Ireland. (2020) *Drone2Map for ArcGIS.* June 15, 2020 from https://www.esriuk.com/en-gb/arcgis/products/drone2map/overview
15. Esri. (2016) *Archaeologists Use a Drone to Map a Dig.* June 15, 2020 from https://www.esri.com/library/fliers/pdfs/drone2map-archaeology.pdf
16. Esri. (2016) *Identifying Beach Erosion with Drone2MapTM for ArcGIS.* June 14, 2020 from https://www.esri.com/library/fliers/pdfs/drone2map-for-arcgis-beach-erosion.pdf
17. Gaygysyz J. et al (2016). Imaging and photogrammetry models of Olduvai Gorge (Tanzania) by Unmanned Aerial Vehicles: A high-resolution digital database for research and conservation of Early Stone Age sites. *Journal of Archaeological Science*. 2016 Issue 75: 40-56.
18. Higgins, James. (n.d.) *Water District Uses Drones for Site Development*. June 15, 2020 from http://digital.ecomagazine.com/publication/?m=&l=1&i=482821&view=articleBrowser&article_id=3038199&ver=html5
19. Otto, A, Agatz, N, Campbell, J, Golden, B, Pesch, E. Optimization approaches for civil applications of unmanned aerial vehicles (UAVs) or aerial drones: A survey. *Networks*. 2018; 72: 411–58. https://doi-org.ezaccess.libraries.psu.edu/10.1002/net.21818
20. Research and markets offers report: Drones (UAVs) in oil and gas industry north america market outlook. (2017, Aug 26). *Entertainment Close - Up* Retrieved on June 1 from http://ezaccess.libraries.psu.edu/login?url=https://search-proquest-com.ezaccess.libraries.psu.edu/docview/1932289324?accountid=13158
21. senseFly. (2016) *The eBee Plus Drone - Aerial Efficiency, Photogrammetric Accuracy*. [Video] Retrieved on July 5, 2020 from https://www.youtube.com/watch?v=N60TAnPo1Cw&list=PL1E88FF1E78727DF7&index=2
22. senseFly. (2020) eBee Rtk+. [Image] retrieved on June 1 2020 from https://www.sensefly.com/drone/ebee-plus-survey-drone/
23. Siebert, S & Teizer, J. (2014) Mobile 3D mapping for surveying earthwork projects using an Unmanned Aerial Vehicle (UAV) System. *Journal of Archaeological Science*. 2014 Issue 41: 1-14.
24. Turner D, Lucieer A, Watson C. (2012) An Automated Technique for Generating Georectified Mosaics from Ultra-High Resolution Unmanned Aerial Vehicle (UAV) Imagery, Based on Structure from Motion (SfM) Point Clouds. *Remote Sensing*. 2012; 4(5):1392-1410.

25. Osen, T. (2020) All images for slideshow unless referenced on slide or above are from screen shots taken from Drone2Map processed imagery and models