24th Annual Mine Design, Operations, and Closure Conference

James Strait (DEQ/MFSA), Craig Jones (DEQ MEPA/MFSA), and Josh Robino (DEQ/REM)

Dr. Strangebuzz

(Or, How I Learned to Stop Worrying and Love Drones)

RC HELICOPTERS AROUND FOR YEARS
CALL IT A DRONE AND EVERYONE LOSES THEIR MINDS
memegenerator.net

There's a difference.

This aircraft is used for search and rescue, surveillance, and military missions.

Dangerous? Only if you're a terrorist.

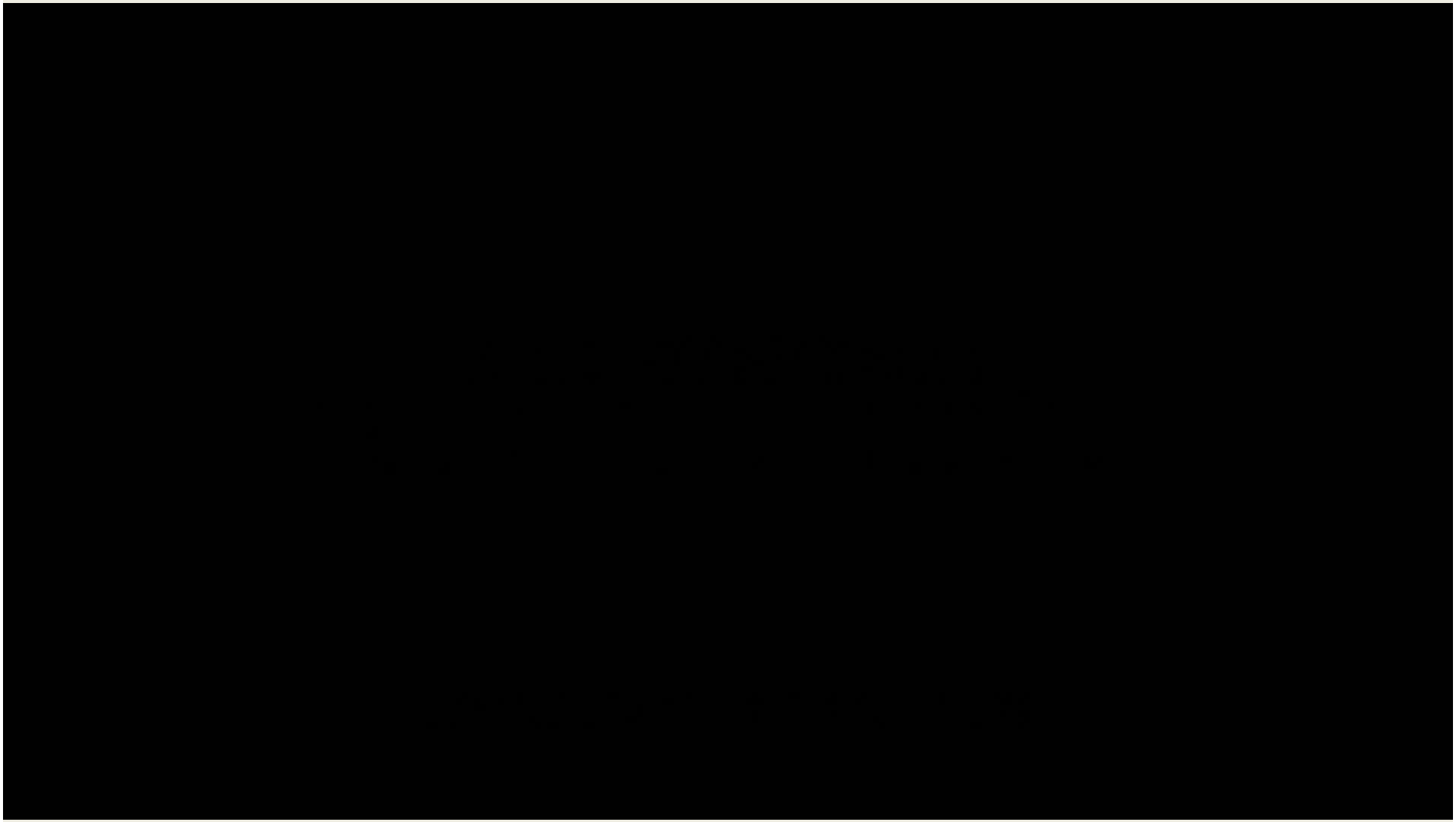
NOT A DRONE

This aircraft is used for fun.
You can buy it at a hobby shop.

Dangerous? Only if you're an idiot.

BIG SQUID RC .com

Why we can’t have nice things…



Federal Aviation Administration Regulations https://www.faa.gov/uas/

Different Types of UAS Operations

- Public Operations (Governmental)
- Civil Operations (Non-Governmental)
- Model Aircraft (Hobby or Recreation *only*)

All UAS more than0.55 lbs ***must be Registered***

- Small UAS Proposed Rulemaking

Public Aircraft Operations

Are limited by federal statue to certain government operations within U.S. airspace. Whether an operation qualifies as a public aircraft operation is determined on a flight-by-flight basis, under the terms of the statute.

This is what DEQ/State falls under.

Requires certification as a state entity, and must apply for ***Certificate of Waiver or Authorization (COA)*** for each and every flight

Broad Area Public COA (BAPC)

Civil Operations (Non-Governmental)

Any operation that does not meet the statutory criteria for a public aircraft operation is considered a civil aircraft operation and must be conducted in accordance with all FAA regulations applicable to the operation. There are currently two methods available:

- *Section 333 Exemption With a COA*
- *Special Airworthiness Certificate*

Model Aircraft Operations

- Fly below 400 feet and remain clear of surrounding obstacles
- Keep the aircraft within visual line of sight at all times
- Remain well clear of and do not interfere with manned aircraft operations
- Don't fly within 5 miles of an airport unless you contact the airport and control tower before flying
- Don't fly near people or stadiums
- Don't fly an aircraft that weighs more than 55 lbs
- Don't be careless or reckless with your unmanned aircraft – you could be fined for endangering people or other aircraft

Small UAS Proposed Rulemaking

(in review by the FAA)

- This proposed framework would allow small UAS operations (less than 55 lbs.) for many different non-recreational purposes, without requiring airworthiness certification, exemption, or a COA
- Still has several requirements and stipulations

DEQ's UAS Fleet

- Phantom Vision 2

- Inspire 1

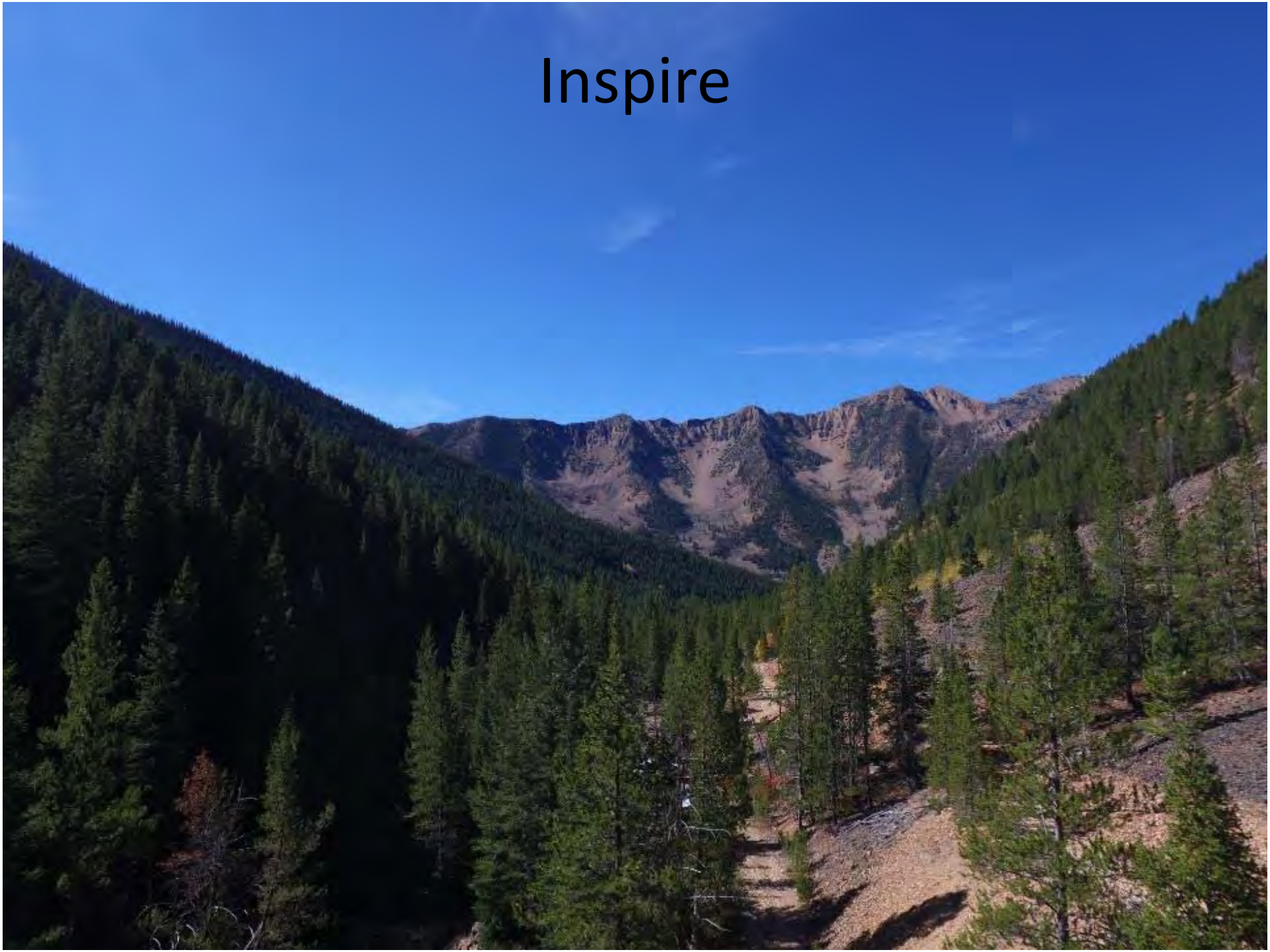
Phantom Vision

Phantom Vision

Inspire

200% Zoom

Inspire



Practical UAS Use

ArcMap Integration

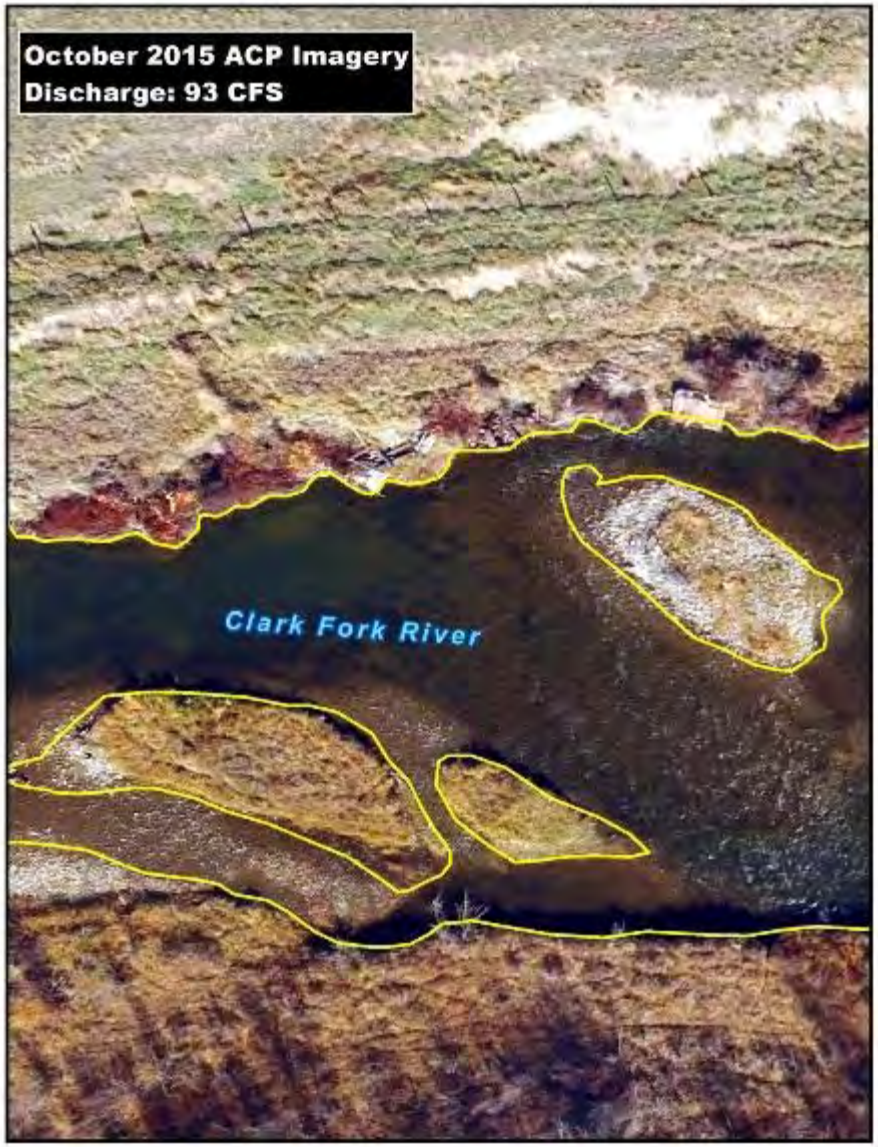
0 10 20 30 40
Feet

ACP elevation: 300 feet
NAIP elevation: approx. 9000 meters

Monitoring Plot P2-08

1:480
One In = 40 Ft

ACP photo point



N

1:360
One In = 30 Ft

0 10 20 30 40
Feet

ACP flight elevation: 300 ft
NAIP flight elevation: 9,000 m

0 10 20 30 40
Feet

ACP flight elevation: 300 feet
NAIP flight elevation: average 9,050 meters (2013)

Monitoring Plot P7-03

1:360
One In = 30 Ft

ACP photo point
Slickens (acres)

0 6 12 18 24
Inches

ACP flight elevation: 20 feet
October 23, 2015

Monitoring Plot P1-01

N

1:24
One In = 2 Ft

ACP photo point

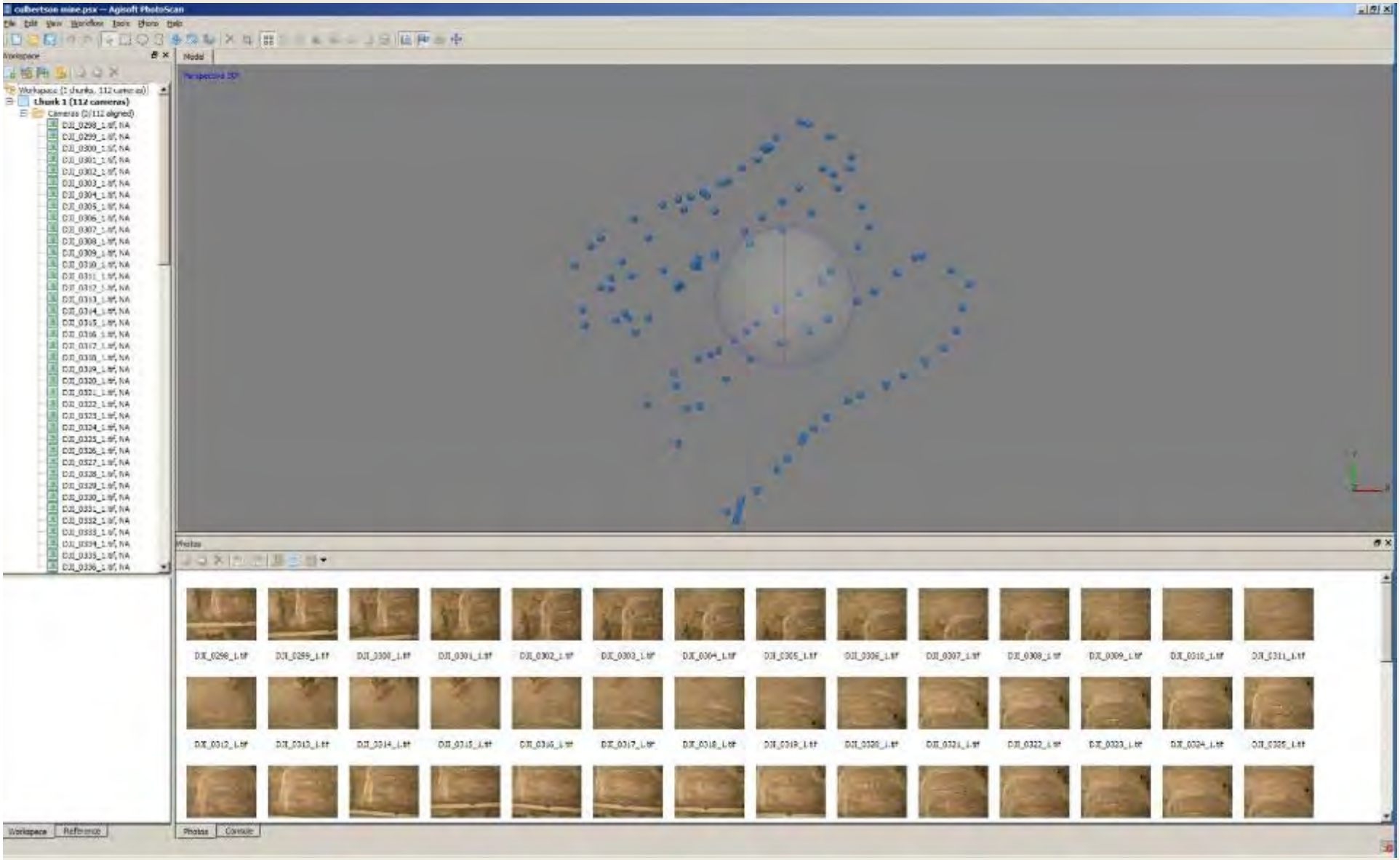
Photogrammetry

Sample 3D Model

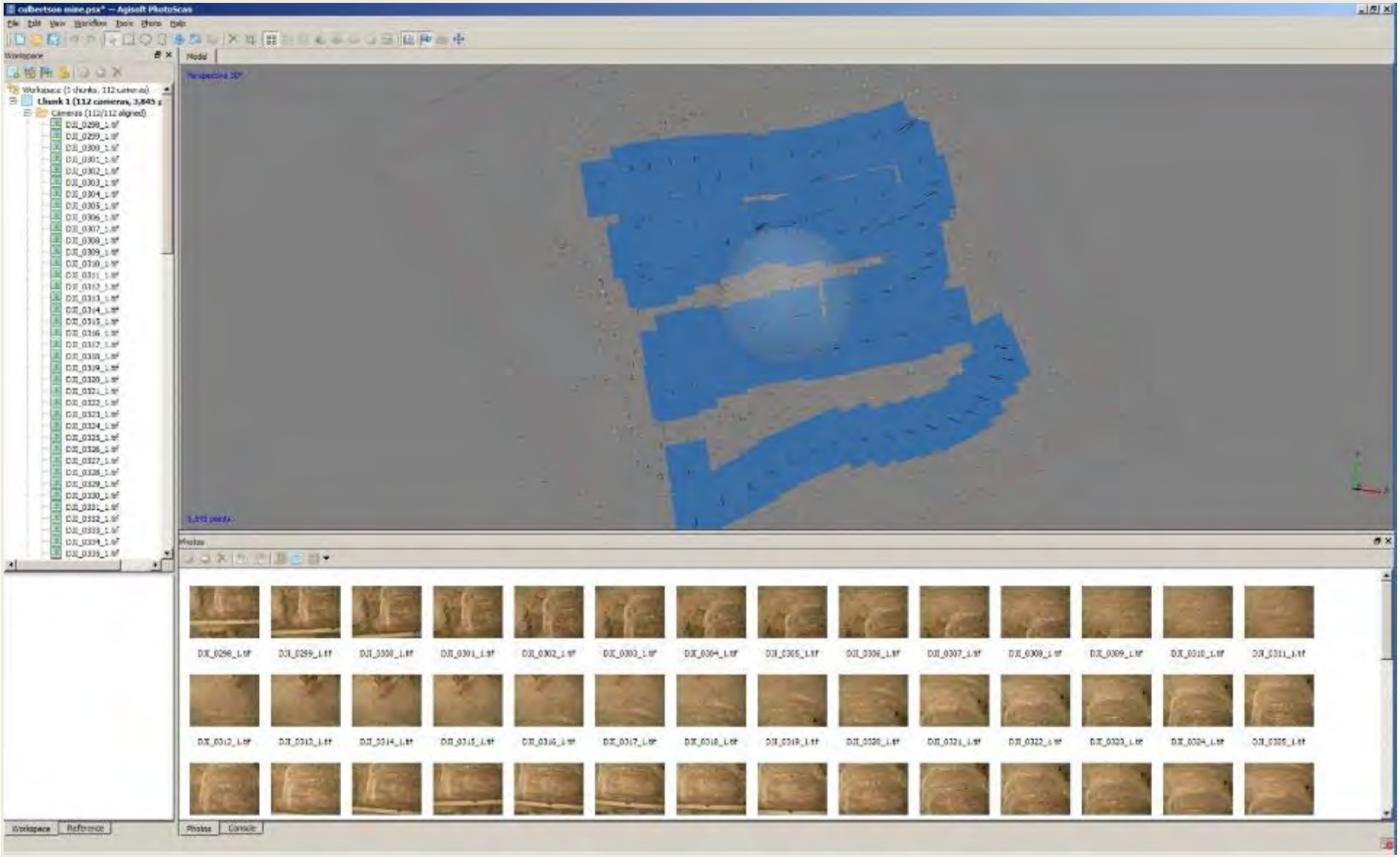
- area B.pdf (Created using the Phantom Vision)
- Beagle 2.pdf (Created using the Inspire)

Creating a 3D Model in Agisoft Photoscan

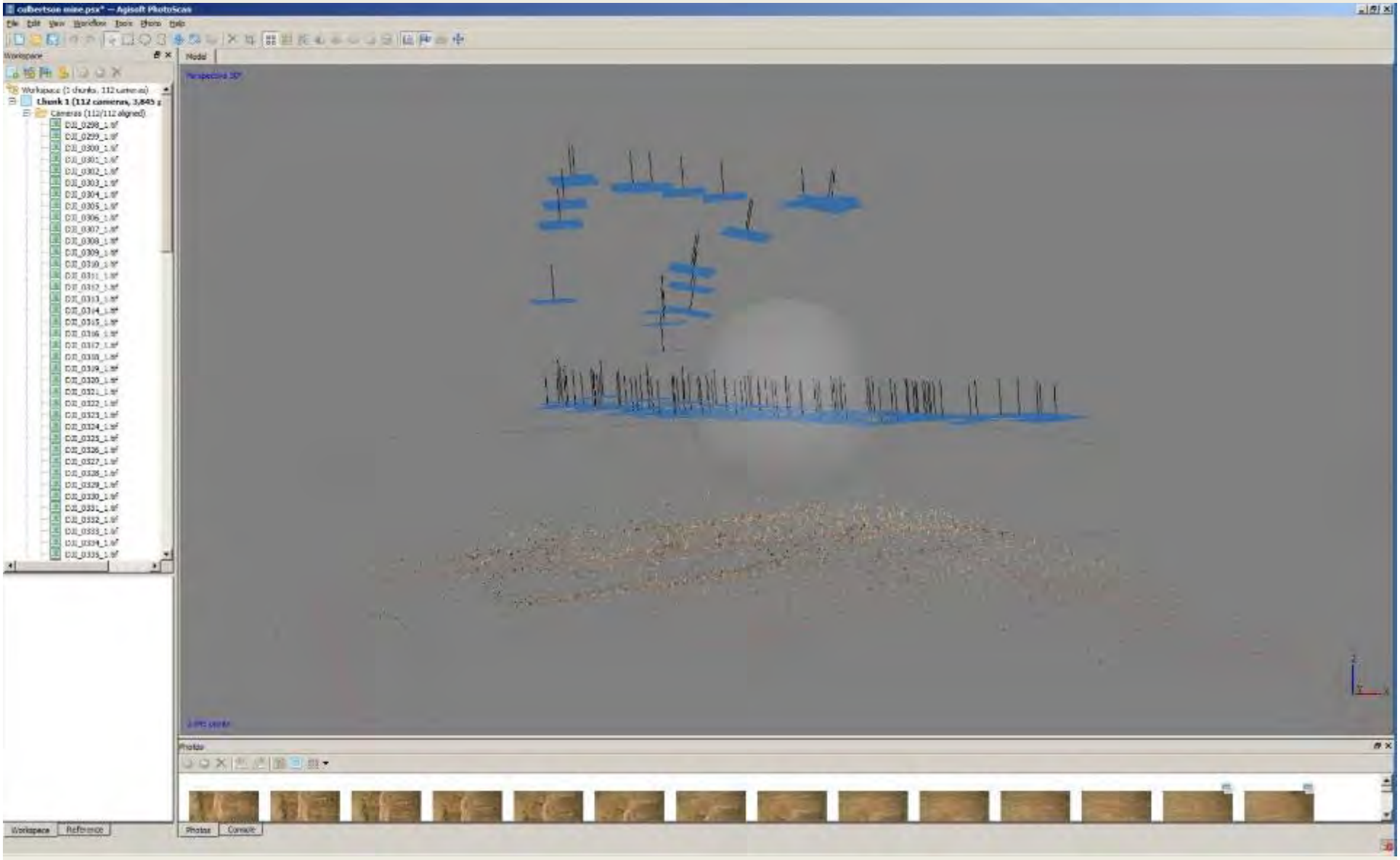
Add Photos


culbertson mine.psx – Agisoft PhotoScan
File Edit View Workflow Tools Photo Help
Workspace
Model
Perspective 3D*
Workspace (1 chunks, 112 cameras)
Chunk 1 (112 cameras)
Cameras (2/112 aligned)
Photos
Workspace
Reference
Photos
Console

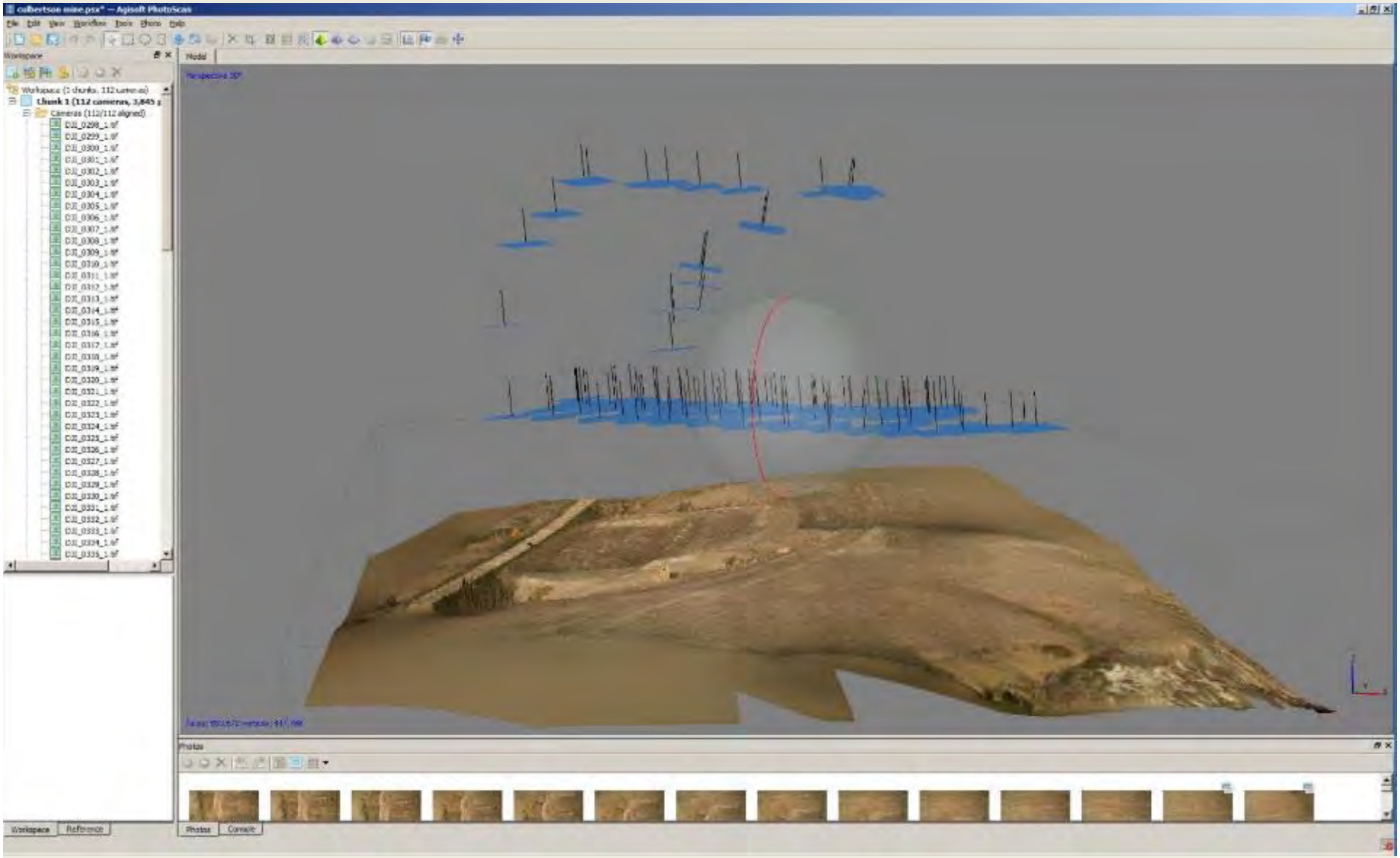
Align Photos



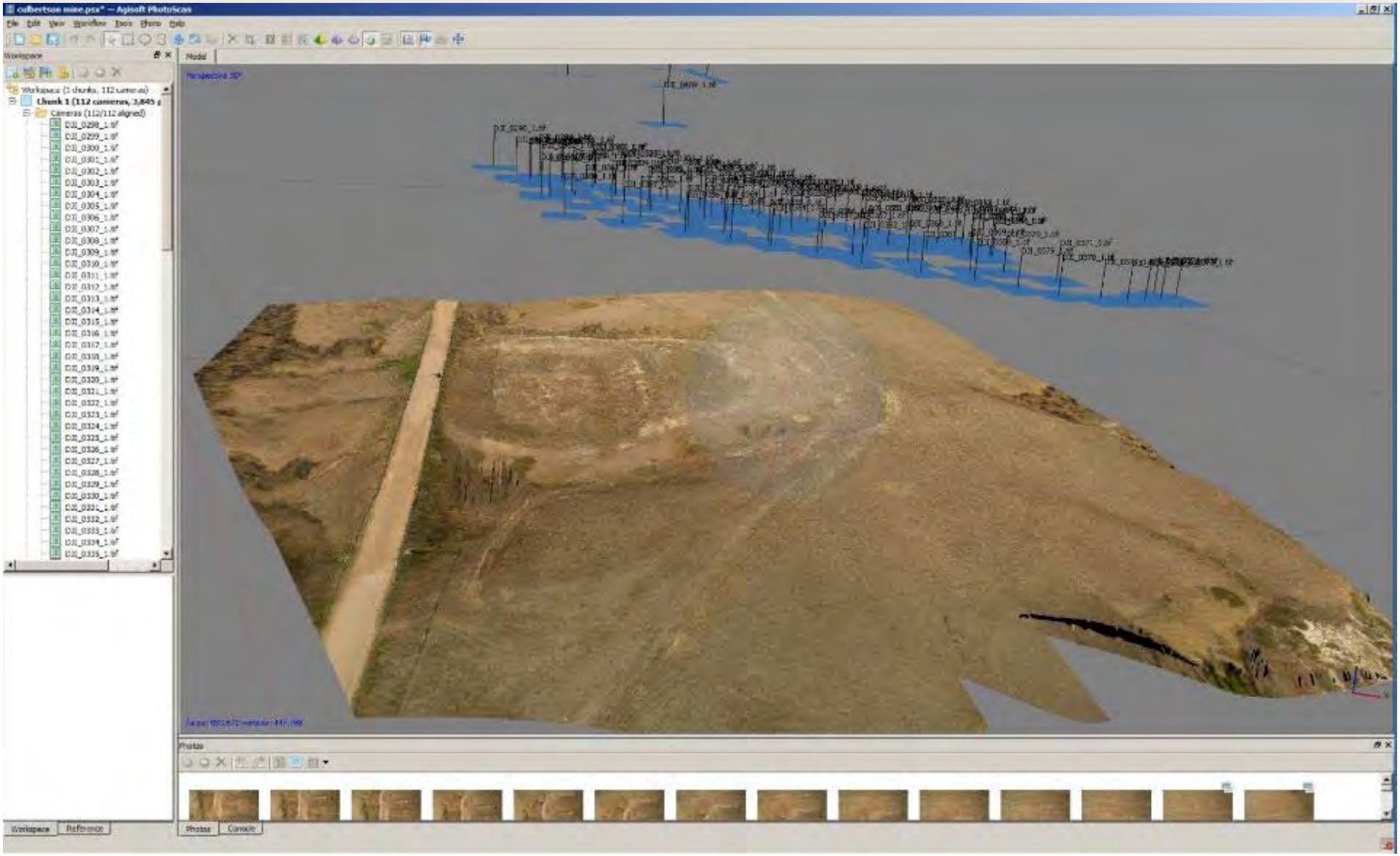
Build Dense Point-Cloud



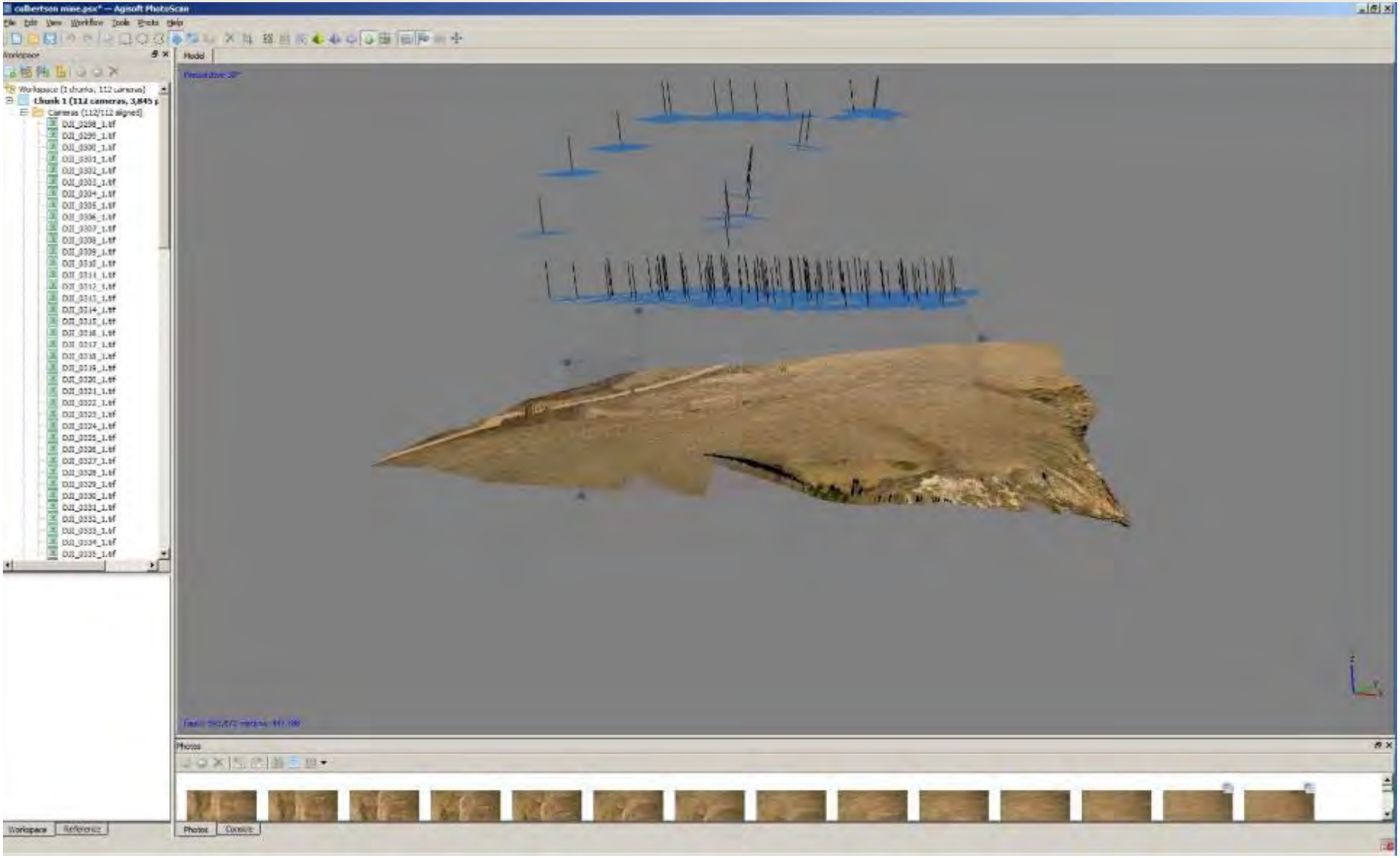
Build Mesh


culbertson mine.psx* – Agisoft PhotoScan
File Edit View Workflow Tools Photo Help
Workspace
Model
Photos
Workspace
Reference
Photos
Console

Build Texture



Resize-Define area



3D PDF Result

- Culberson2.pdf

- Other output options:
  - DEM
  - Points (point cloud)
  - Model
  - Orthomosaic
  - Report
  - Area and Volume calculations
  - Vegetation indices with multispectral imagery

Georeferenced using ArcMap

Culbertson Mine Subsidance Feature

1:250

0 5 10 20 30 40 Feet

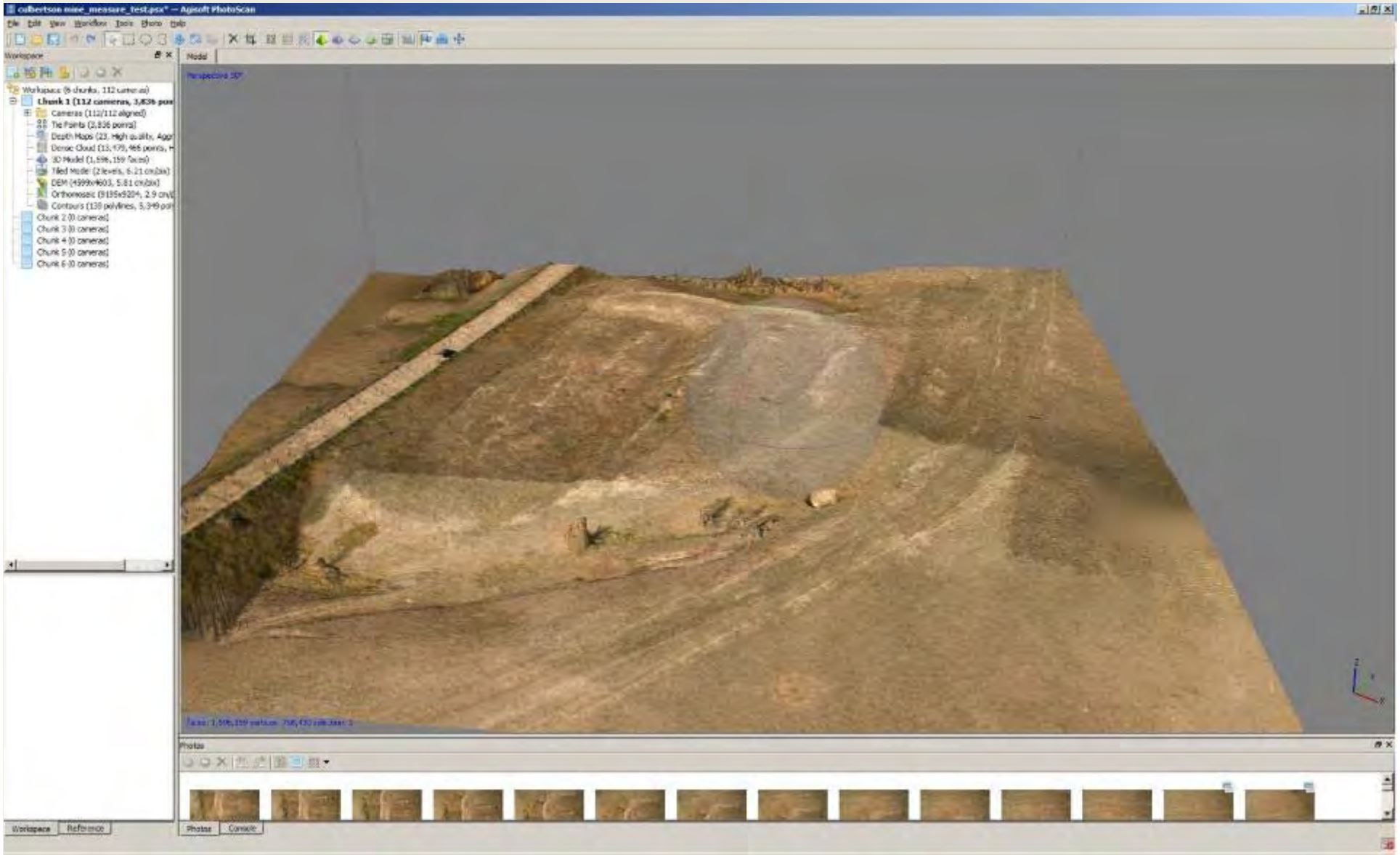
Culbertson Mine Subsidance Feature

1:250

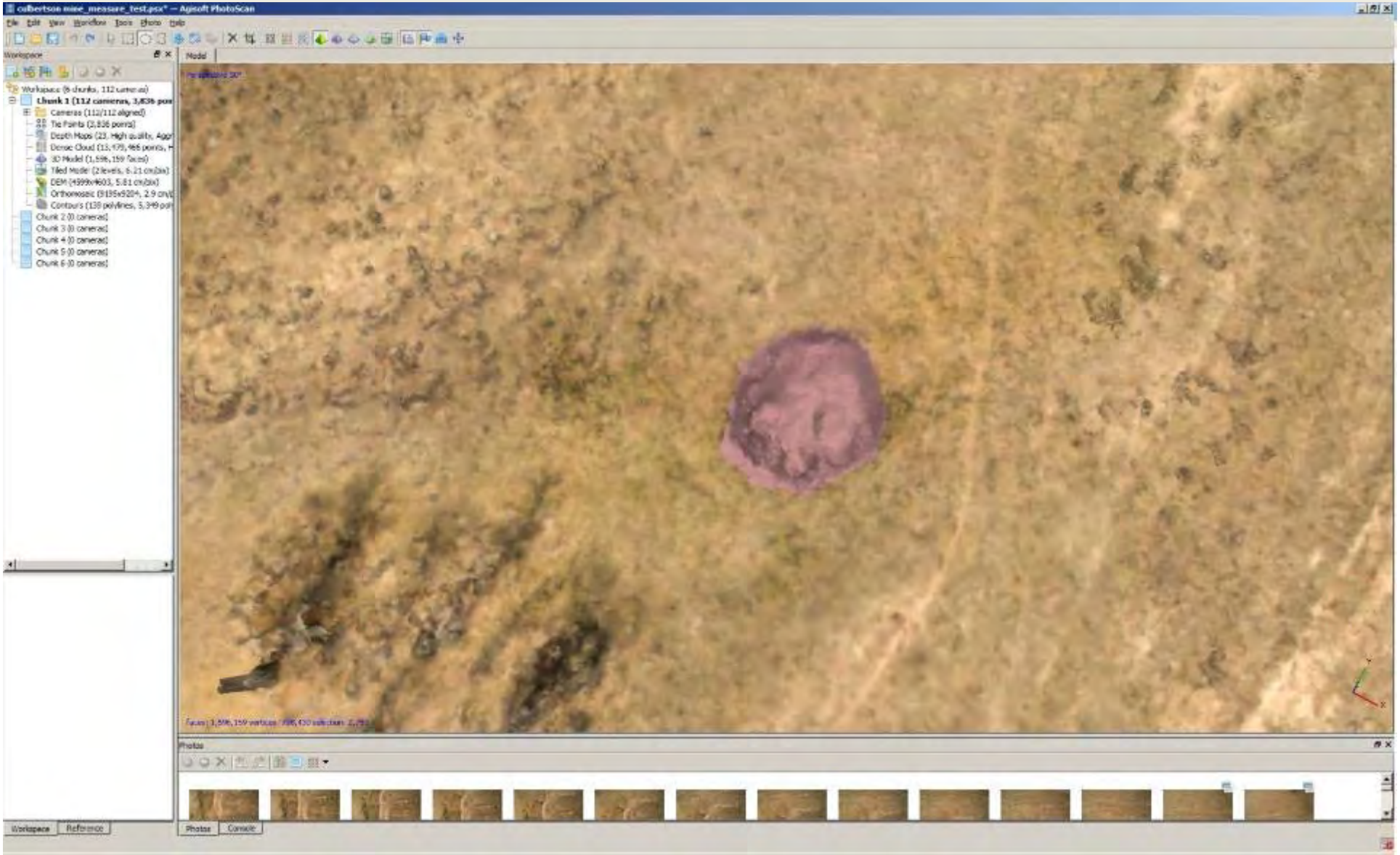
0 5 10 20 30 40 Feet

Calculating Volume

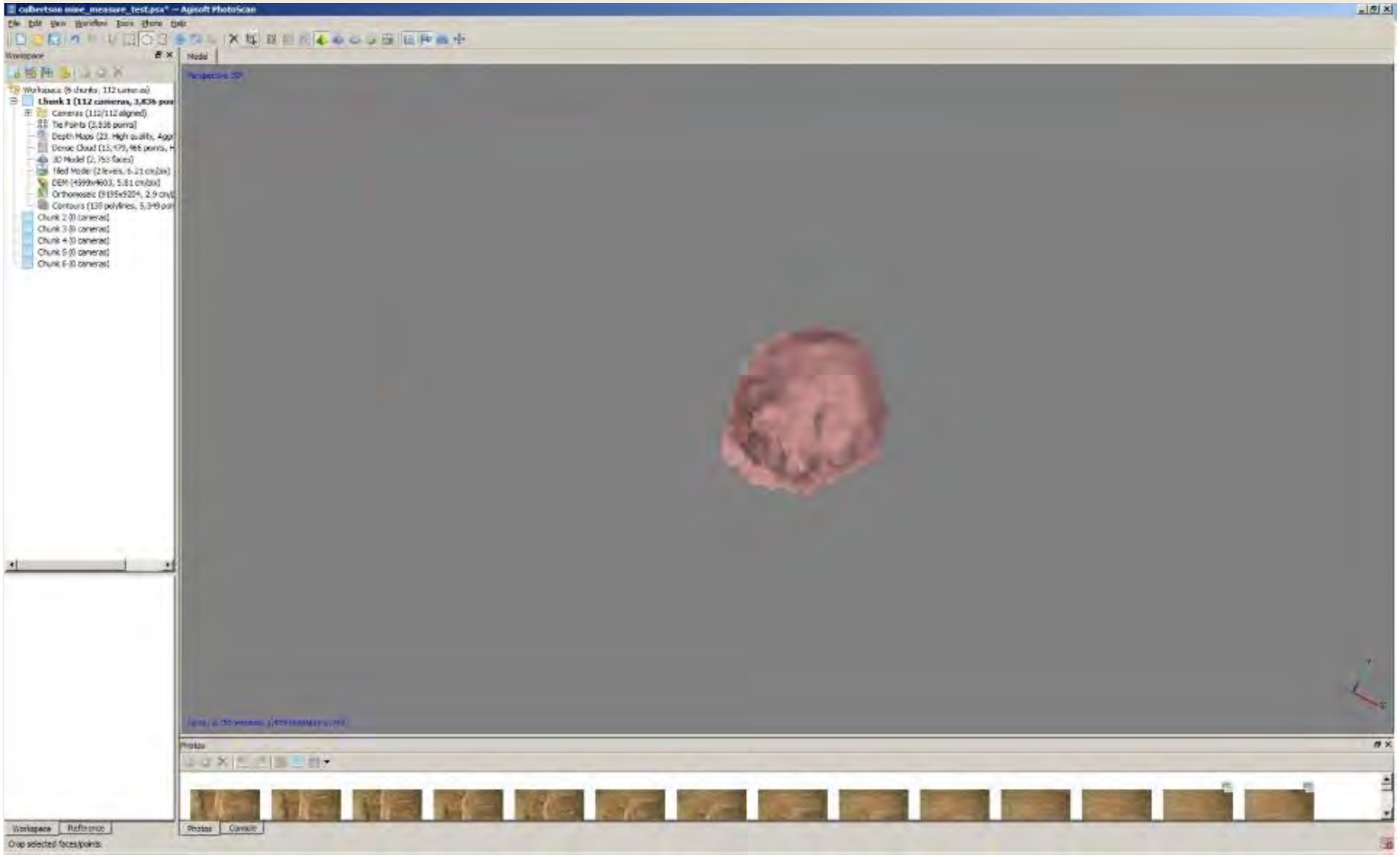
Build Mesh



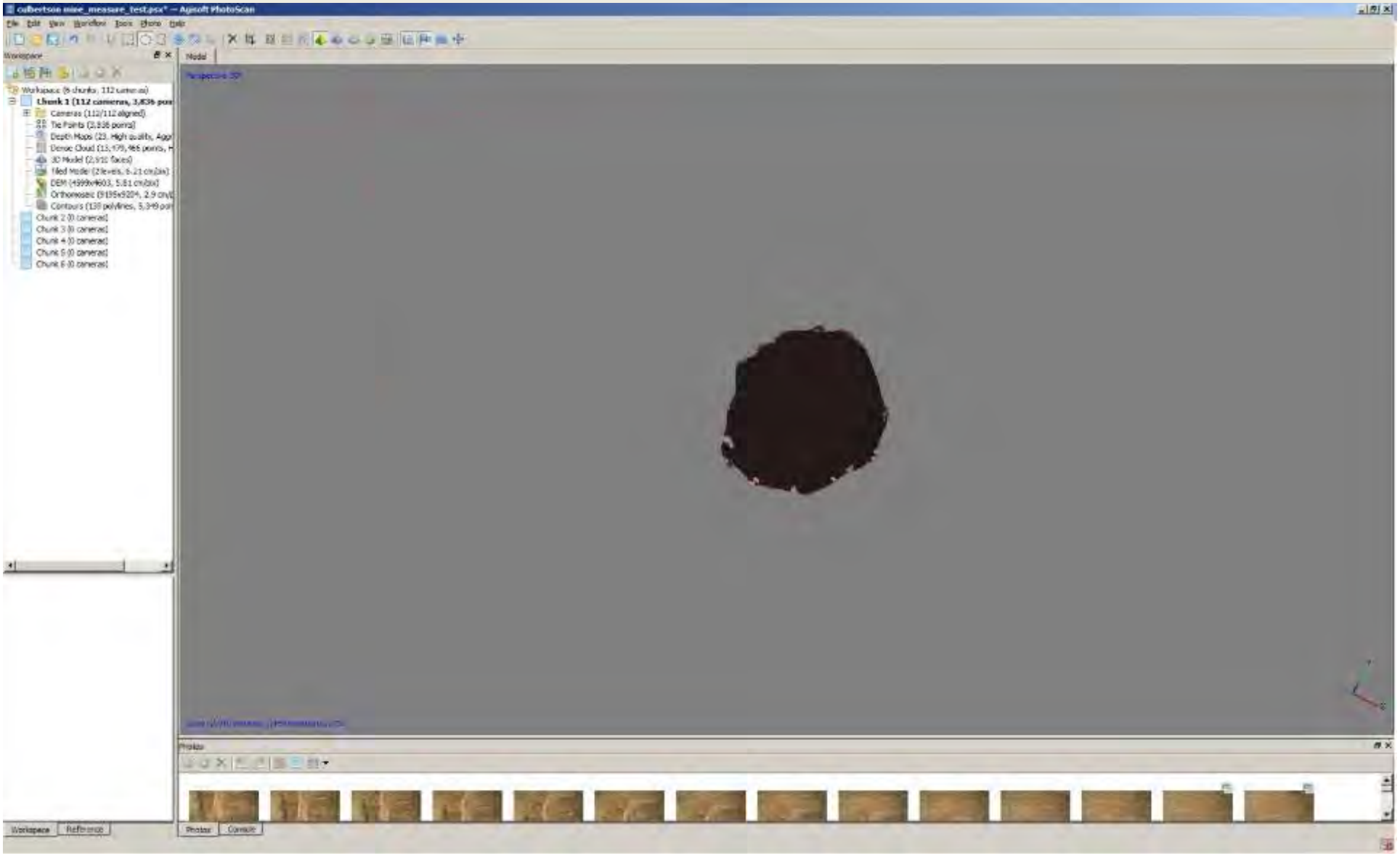
Select Area


Workspace
Model
Photos
Workspace
Reference
Photos
Console

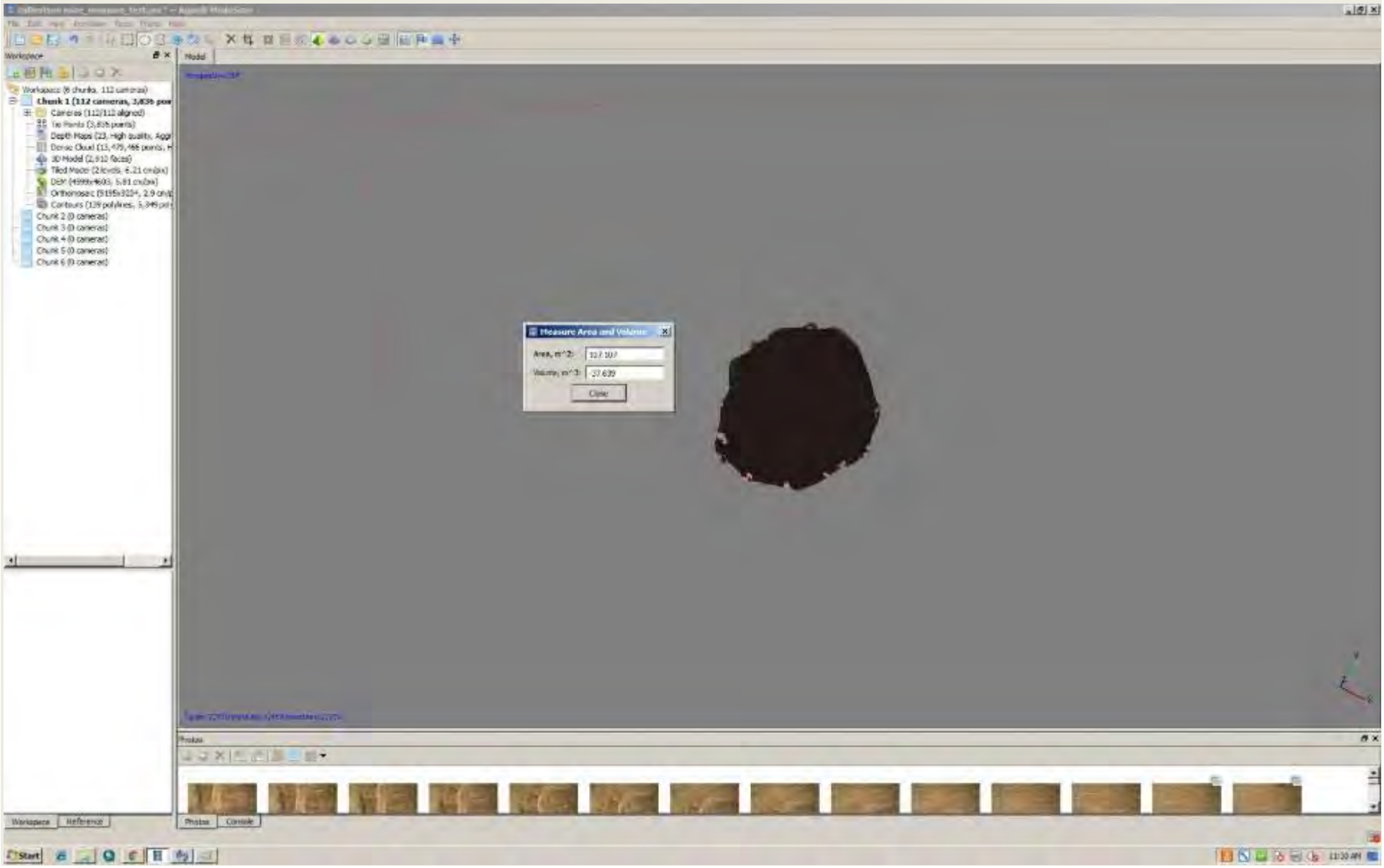
Clip Faces (Crop)



“Close Holes”



Calculate Area and Volume



What does the future of UAS look like?

Emergency Response

Enables immediate action, providing emergency response teams with fast, flexible visibility to assess critical situations.

Utilities

Safely allows for the quick inspection of high voltage power lines and wind turbines, helping mitigate worker risk and improve monitoring.

Military & Defense

Assisting with intelligent surveillance and reconnaissance missions to deliver timely, relevant, and assured information to thwart potential threats.

Oil & Gas

Protects and helps maintain extensive miles of pipeline covering large, remote areas that would otherwise require enormous amounts of time and resources.

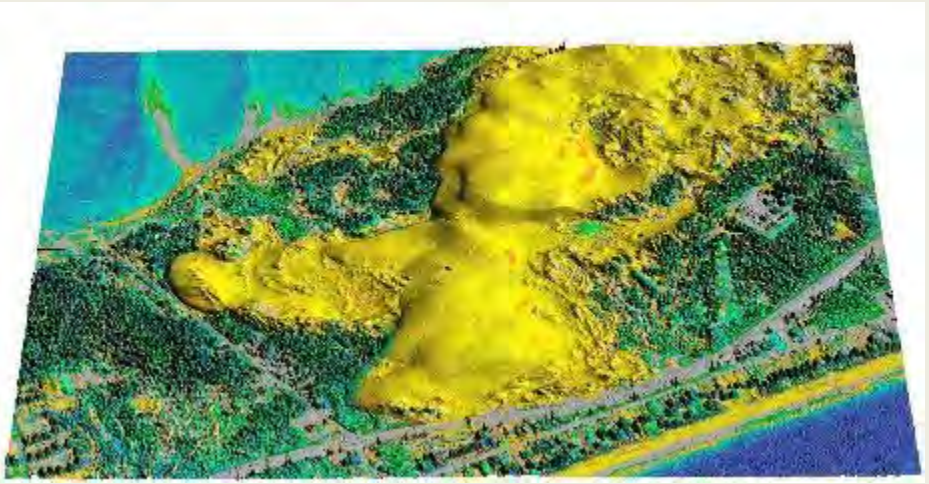
Agriculture

Creates more efficient farms by monitoring inventory, growth, water and fertilizer levels, and crop health to facilitate production and increase yields.

Public Safety

Supporting firefighting operations by providing more up-to-date information at a lower cost, while reducing the number of responders in harm's way.

LiDAR



Puck LITE™

OUR LIGHTEST SENSOR EVER

KEY FEATURES

- 590 grams
- Dual Returns
- 16 Channels
- 100 m Range
- 300,000 Points per Second
- 360° Horizontal FOV
- ± 15° Vertical FOV
- Low Power Consumption
- Protective Design
- Connectors: RJ45 / M12

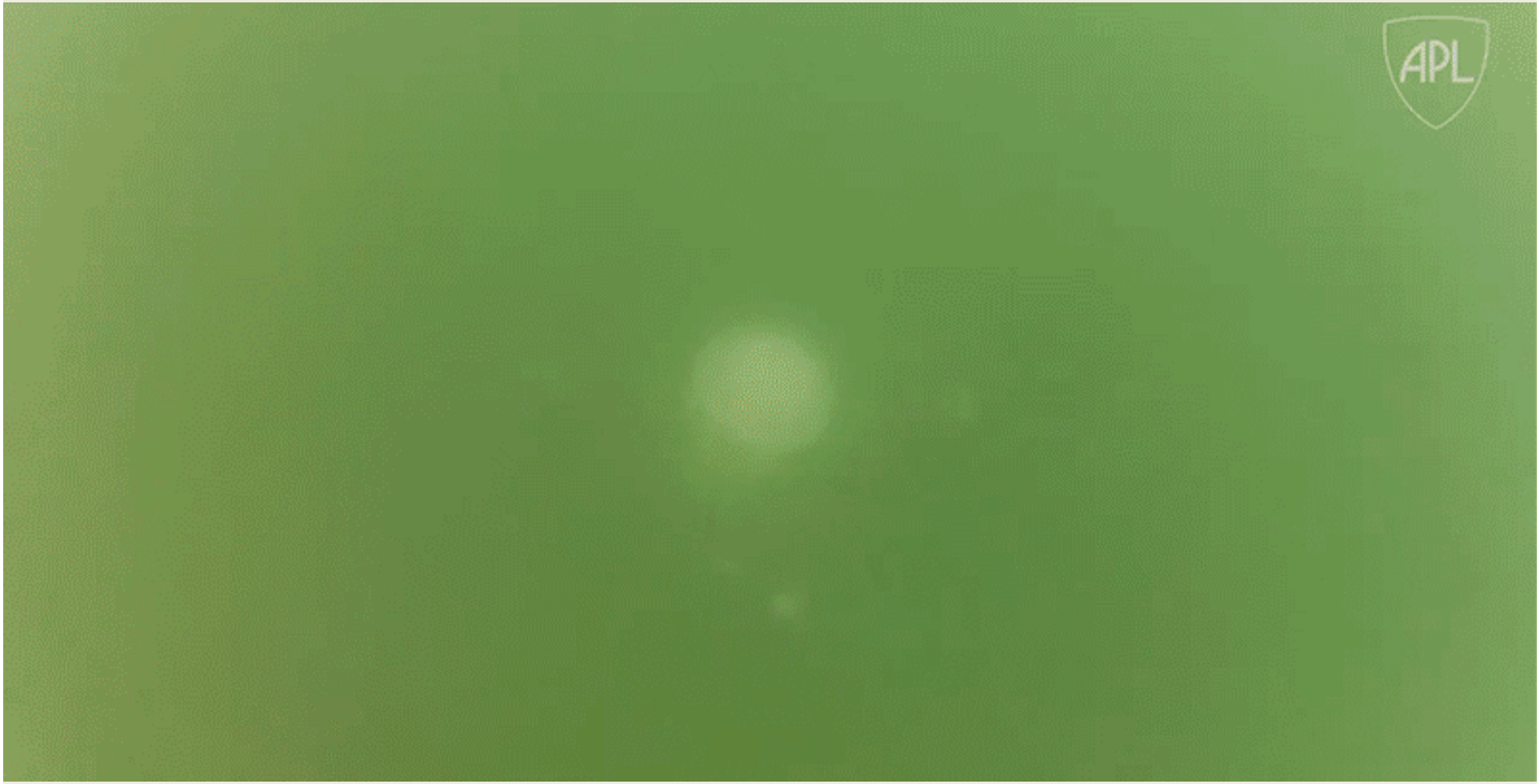
FAA predicts that UAV's will spawn a $90 billion industry within a decade.

“Personal” Drones

Flyability Gimball Drone

CRACUNS

Corrosion Resistant Aerial Covert Unmanned Nautical System



Swarms

Autonomous Construction

In 2011, researchers presented a six-meter (20 ft) tall tower constructed from 1,5000 polystyrene bricks, every one of which neatly assembled without any assistance from a human hand

Entertainment