

Program Outline

Using Ortho, Lidar and Thermal Imaging

Introduction Mike Ritchie, PE, PLS, CP

Imagery and LiDAR Clay Smith, PLS, CP

Break

Aerial LiDAR Mapping. Paul Bishop Sr. LiDAR Manager

Break

Thermal Imaging. Andrew Brenner Ph.D

Questions

Photo Science History & Background

- 1974 – Founded in Lexington
- 1991 – Ownership change
- Today, nearly 200 professionals... exclusively Geospatial
- Full-service Surveying, Mapping, Remote Sensing, and GIS capabilities
- Corporate Headquarters:
 - Lexington, Kentucky

Photo Science has merged with
AeroMetric and Watershed Sciences
to form the largest
Geospatial Services firm in the Nation.



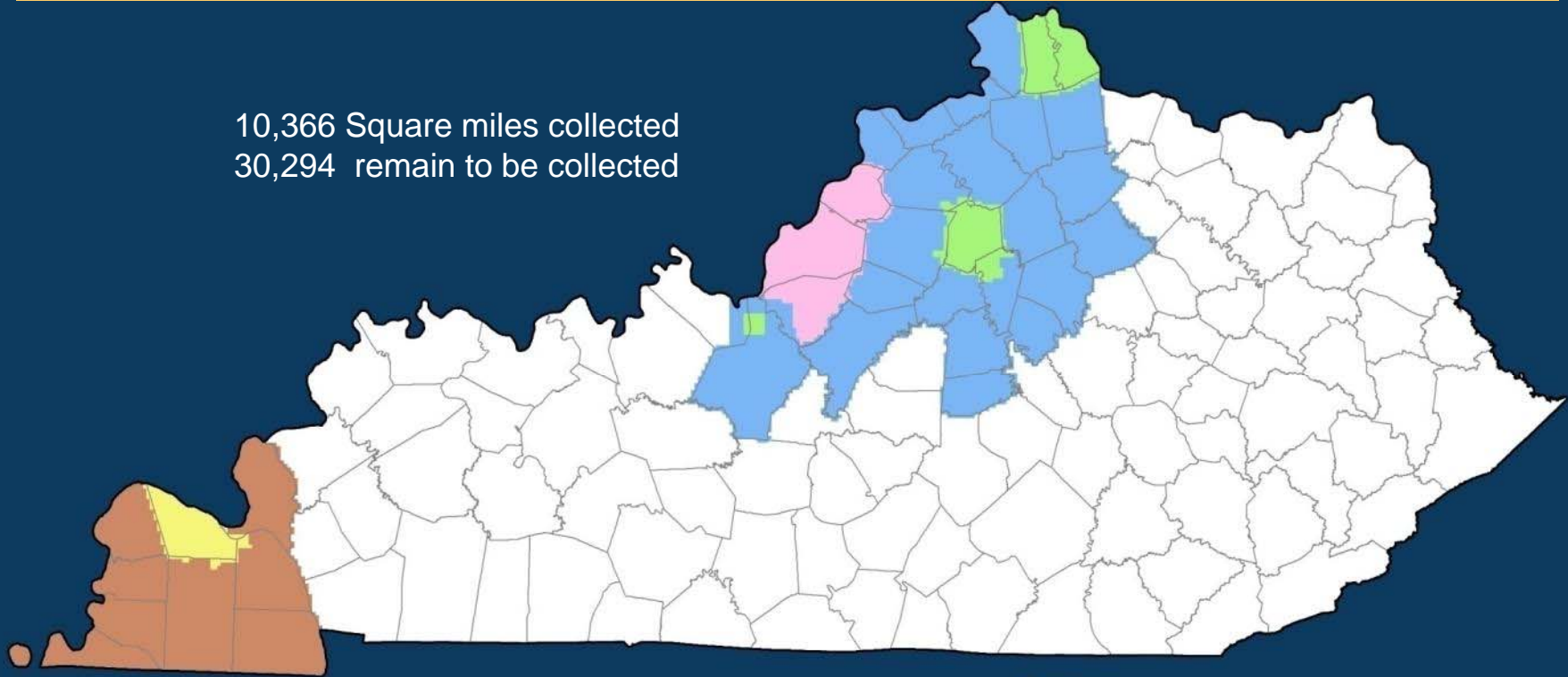


17 Offices Nationwide



Current Imagery Coverage Area

10,366 Square miles collected
30,294 remain to be collected



Grouping

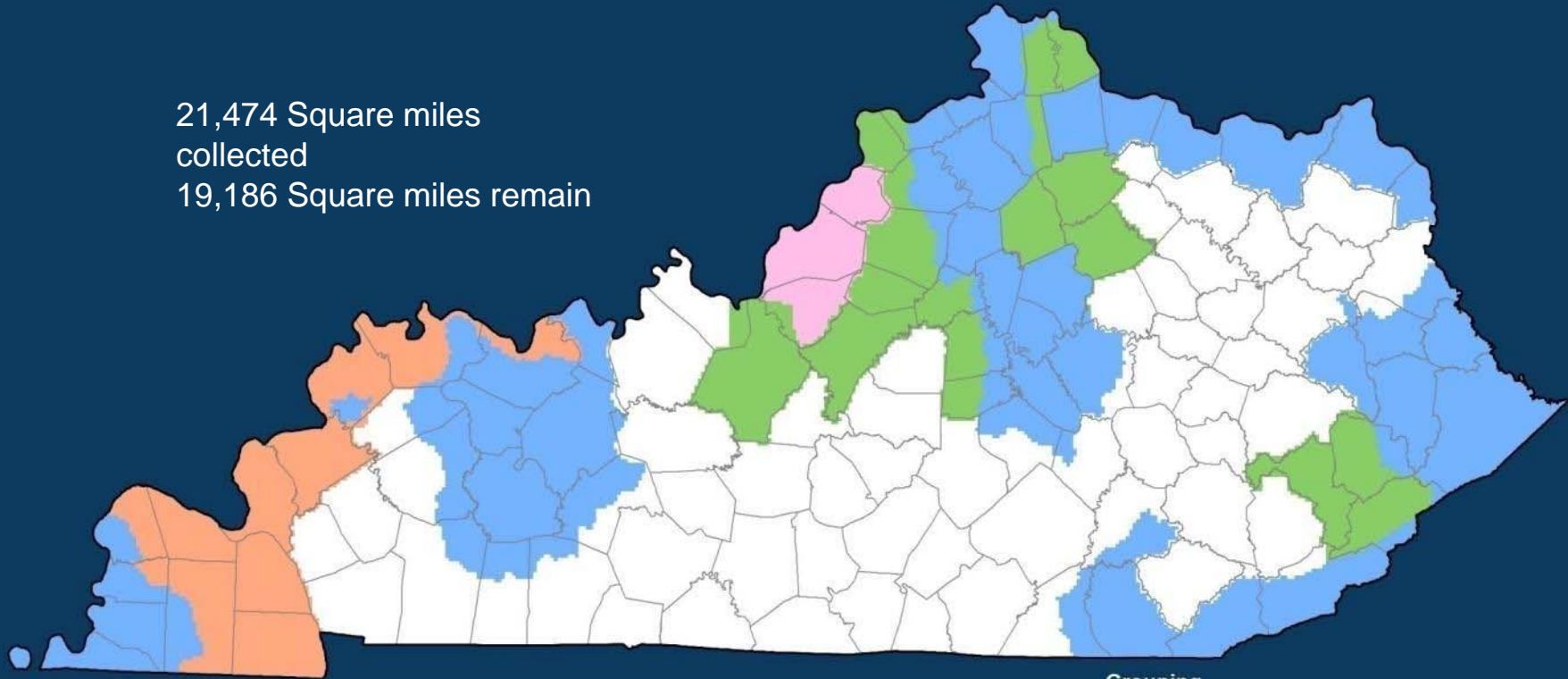
- Future Imagery Collection (34,307 Tiles - 30,294.4 mi²)
- 2012 KY Statewide Imagery - 6 Inch (849 Tiles - 739.8 mi²)
- 2012 KY Statewide Imagery - 12 Inch (6,532 Tiles - 5,787.3 mi²)
- 2013 KY Statewide Imagery - 6 Inch (373 Tiles - 323.2 mi²)
- 2013 KY Statewide Imagery - 12 Inch (3,085 Tiles - 2,637.3 mi²)
- LOJIC (1,015 Tiles - 878.4 mi²)

0 12.5 25 50 75 100 Miles








Current LiDAR Coverage Area

21,474 Square miles
collected
19,186 Square miles remain



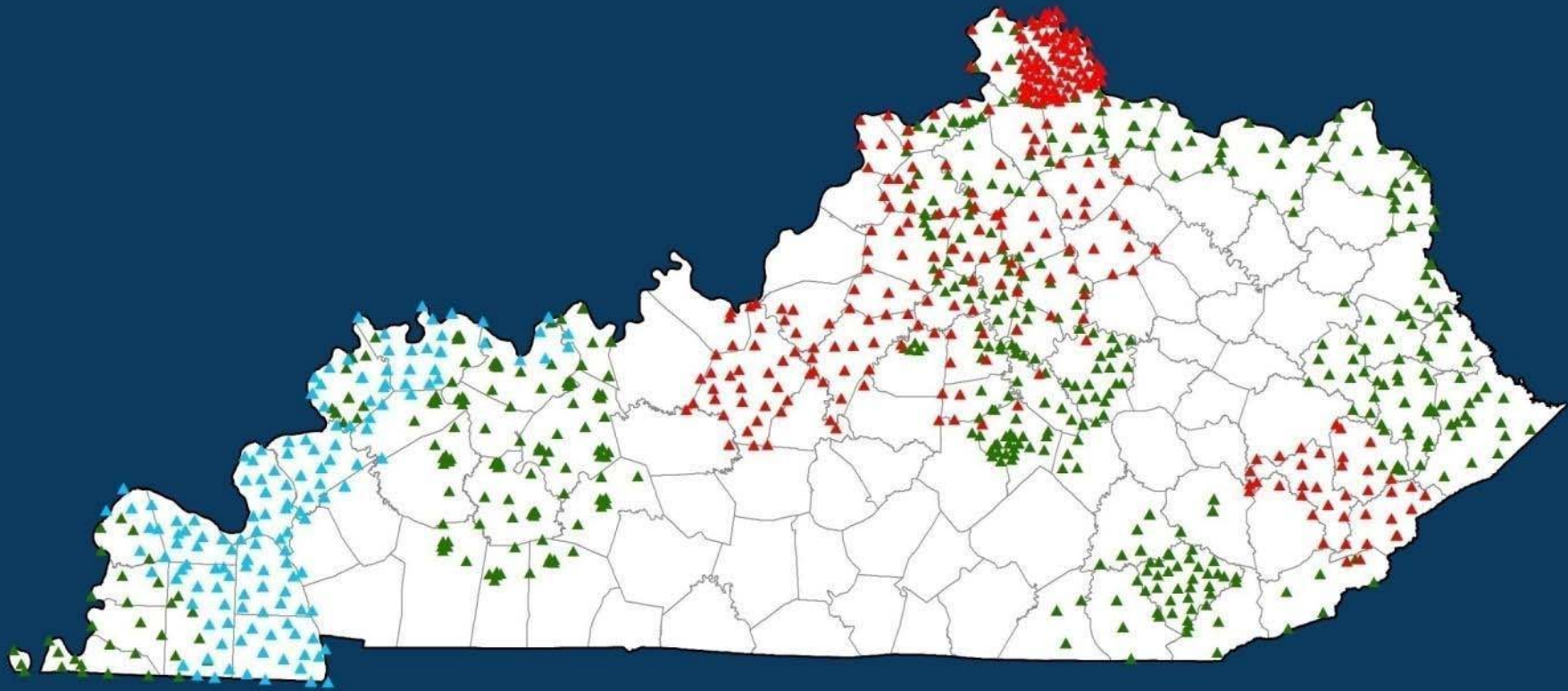
Grouping

-  Future LiDAR Collection (21,546 Tiles - 19,186.4 mi²)
-  2012 KY Statewide LiDAR (5,576 Tiles - 4,781.9 mi²)
-  2013 KY Statewide LiDAR (3,823 Tiles - 3,270.4 mi²)
-  DOW/NRCS (14,605 Tiles - 12,543.3 mi²)
-  LOJIC (1,015 Tiles - 878.4 mi²)

0 12.5 25 50 75 100
Miles



Survey Control



0 12.5 25 50 75 100 Miles

Control Points

- ▲ 2012 Control
- ▲ 2013 Control
- ▲ DOWNRCS

Imagery and Orthos

- Clay Smith CP, PLS
- Production Manager
- Photo Science



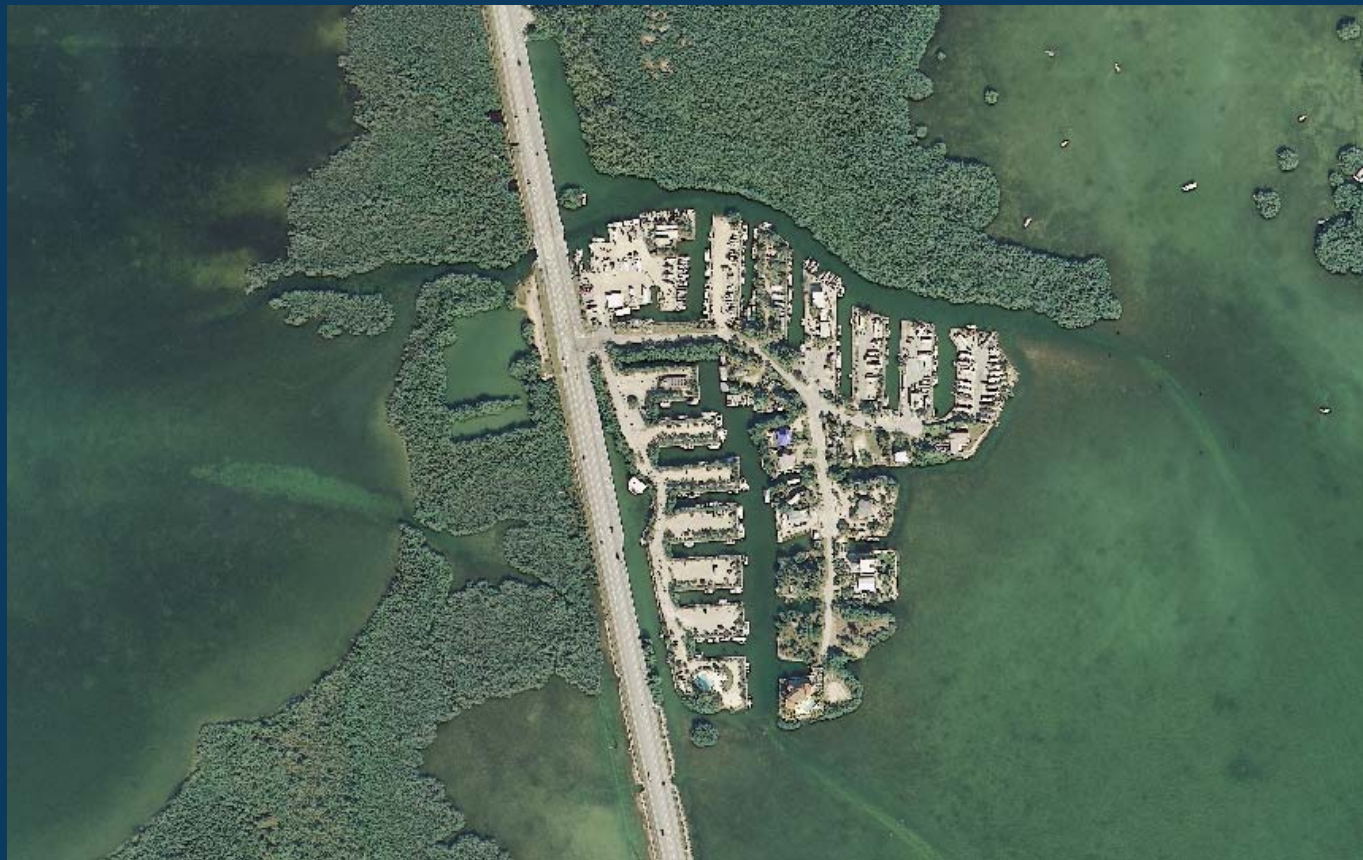
Presentation Outline

- Project Planning
- Acquisition
- Post Processing
- Ortho Production
- Final Products

Project Planning

- Purpose of project
 - What will the data be used for?
 - How big is the area?
- Resolution
 - What do you want to be able to see on the ground?
- Accuracy
 - Relative accuracy and absolute accuracy.
 - What is the accuracy of your surface model?

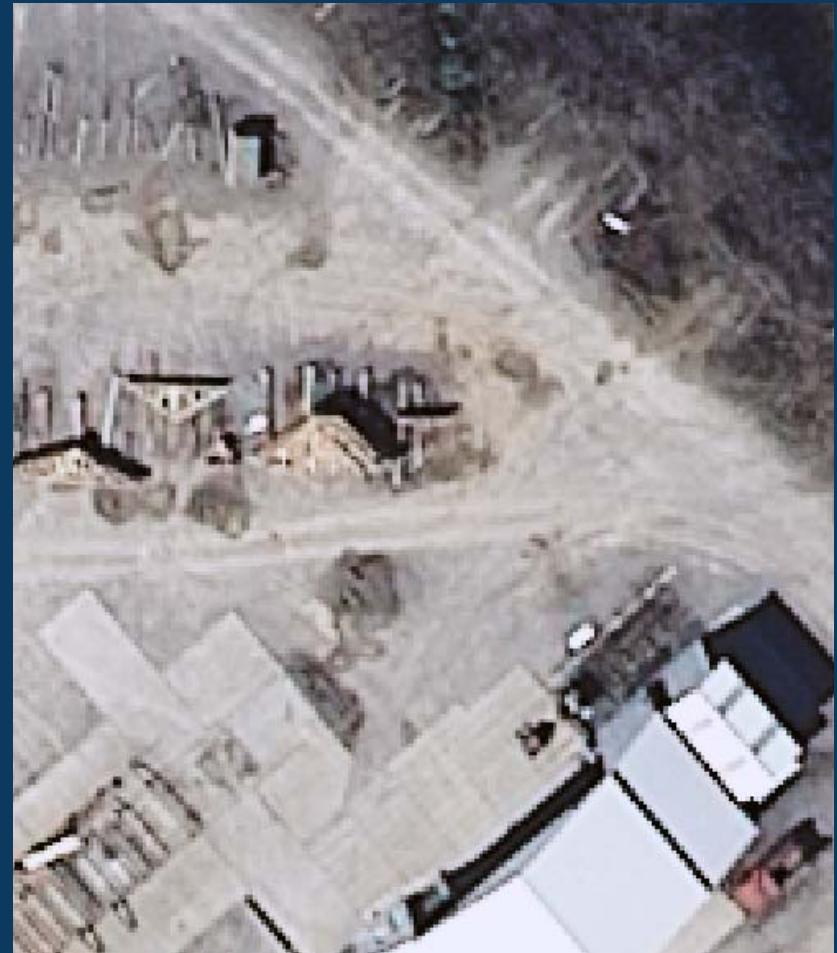
Florida Seagrass Mapping



Corridor Mapping



Resolution 6" and 12"



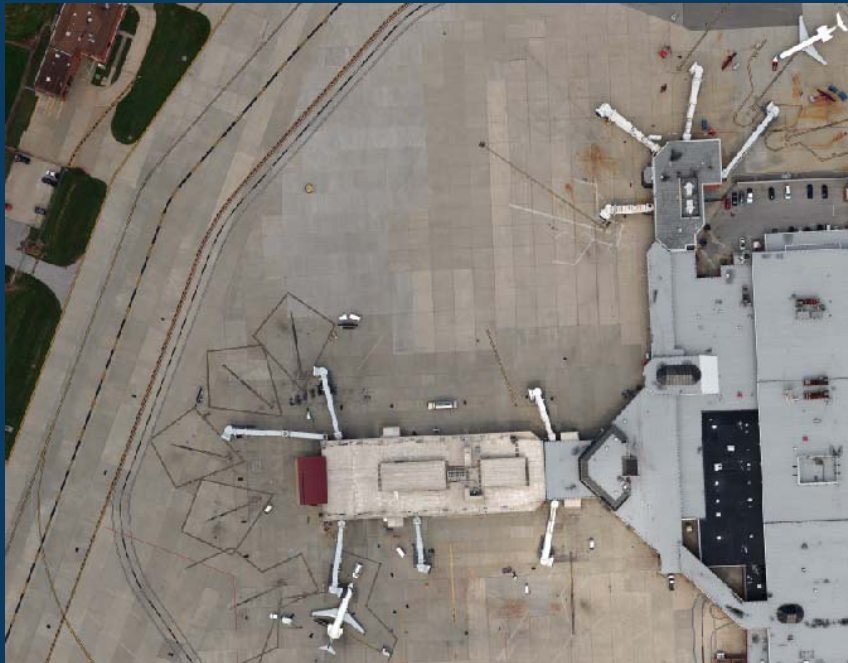
3" Resolution



2" Resolution



1" Resolution



1" Resolution



Existing Data

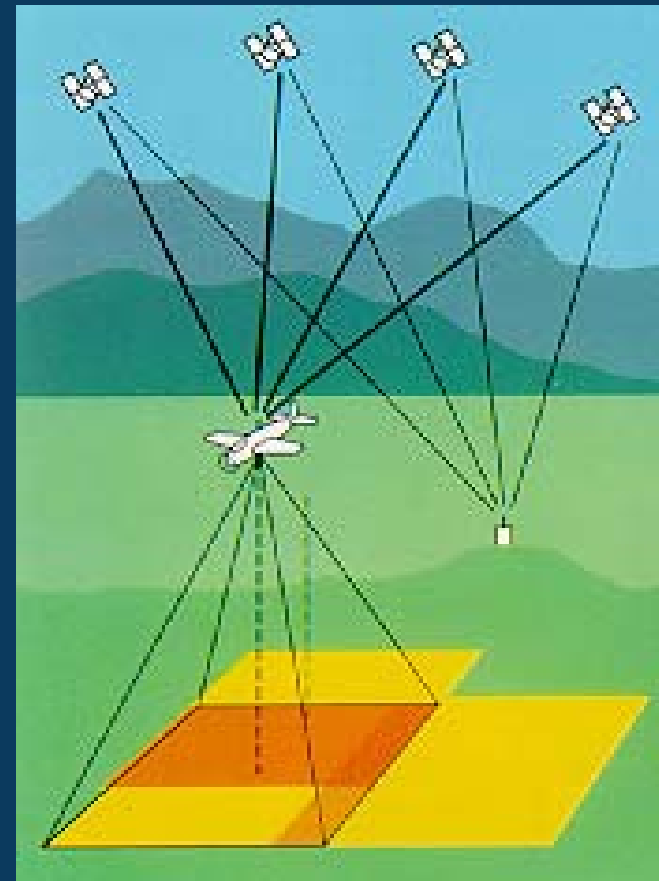


Acquisition

- Platform types
 - Planes, Helicopter, Unmanned
- Atmospheric and ground conditions
 - Clouds, standing water, snow, sun angle
 - On 1/1/14 there is zero 30 degree sun
 - On 1/30/14 11:30-2:00 2.5 hours of 30 degree sun
- Other limitations
 - Restricted Airspace, Commercial traffic, PDOP (Positional Dilution of Precision)

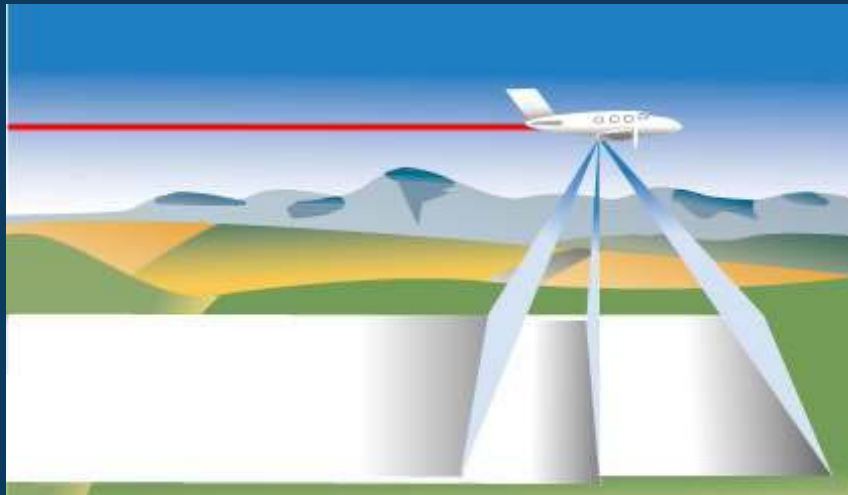
Aerial Surveying Concept

Airborne GPS
Inertial Motion Units
Multiple Digital Sensors
Aerial
LiDAR
Mobile

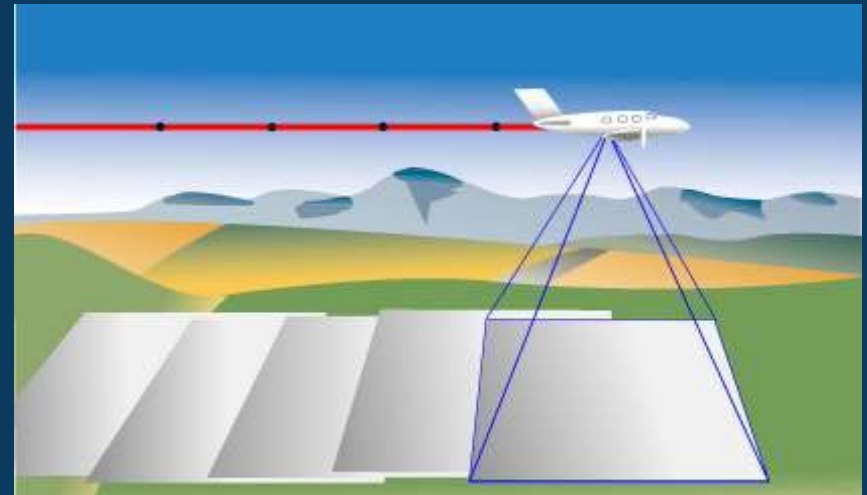


Sensor Types

Continuous Pushbroom Scanning



Frame Based Sensor

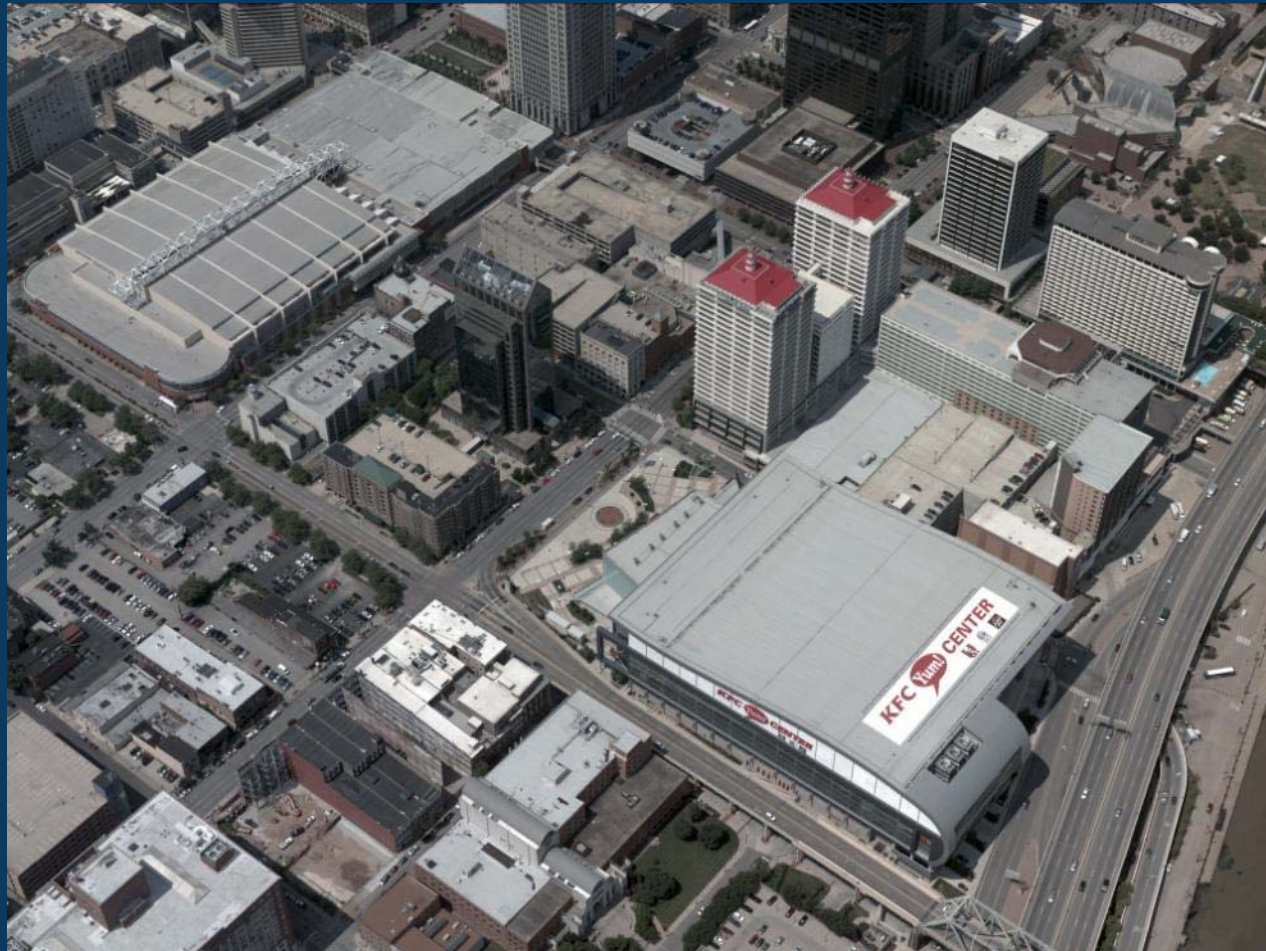


RCD 30 Oblique Camera



- Simultaneous nadir, forward oblique, and aft oblique imagery
- 45 degree look angle for oblique sensors
- Sustained cycle rate of 1.6 seconds per set of (three) frames - forward, aft, down

Oblique Imagery 2" Resolution



Oblique 2" Resolution

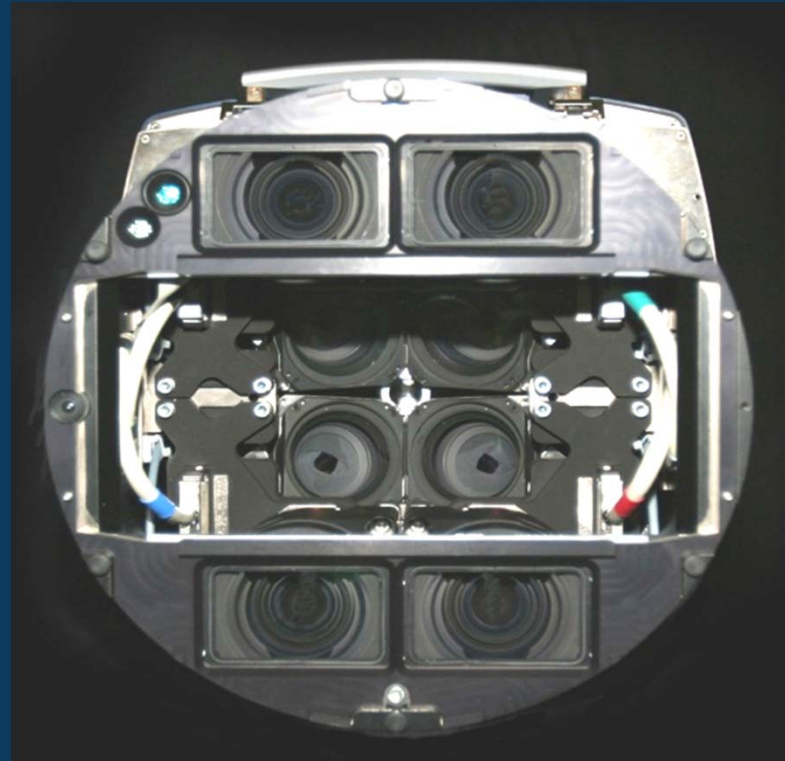


.8" Resolution

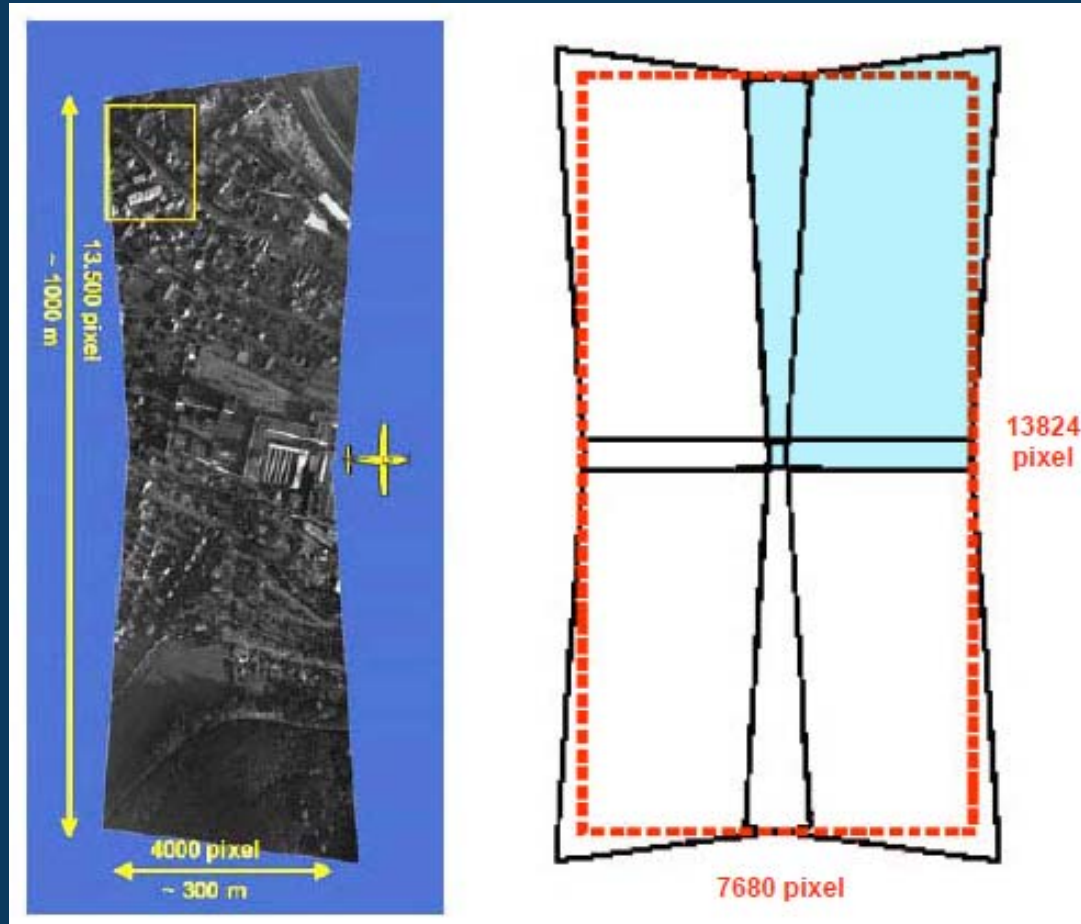


DMC

- **Z/I Imaging DMC System (Large Format Framing)**
- **120 mm focal length**
- **CCD pixel size 12 microns**
- **Radiometric resolution: 12 Bit**
- **8 cameras**
- **Individual Frames**



DMC Raw Image



Digital Cameras



Vexcel Ultra CamX
Digital Mapping System



Applanix DSS-439
Digital Sensor Systems

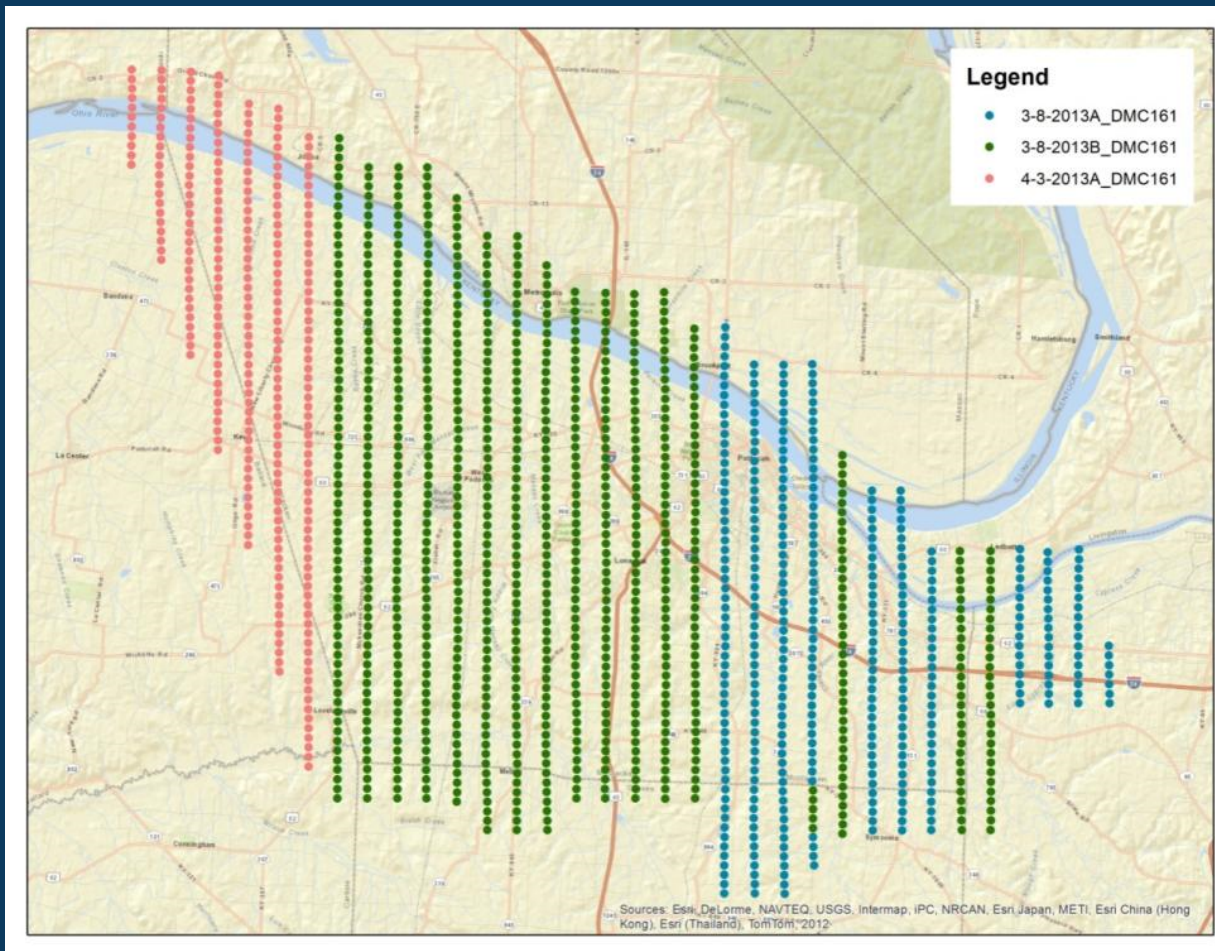
Camera inside of plane



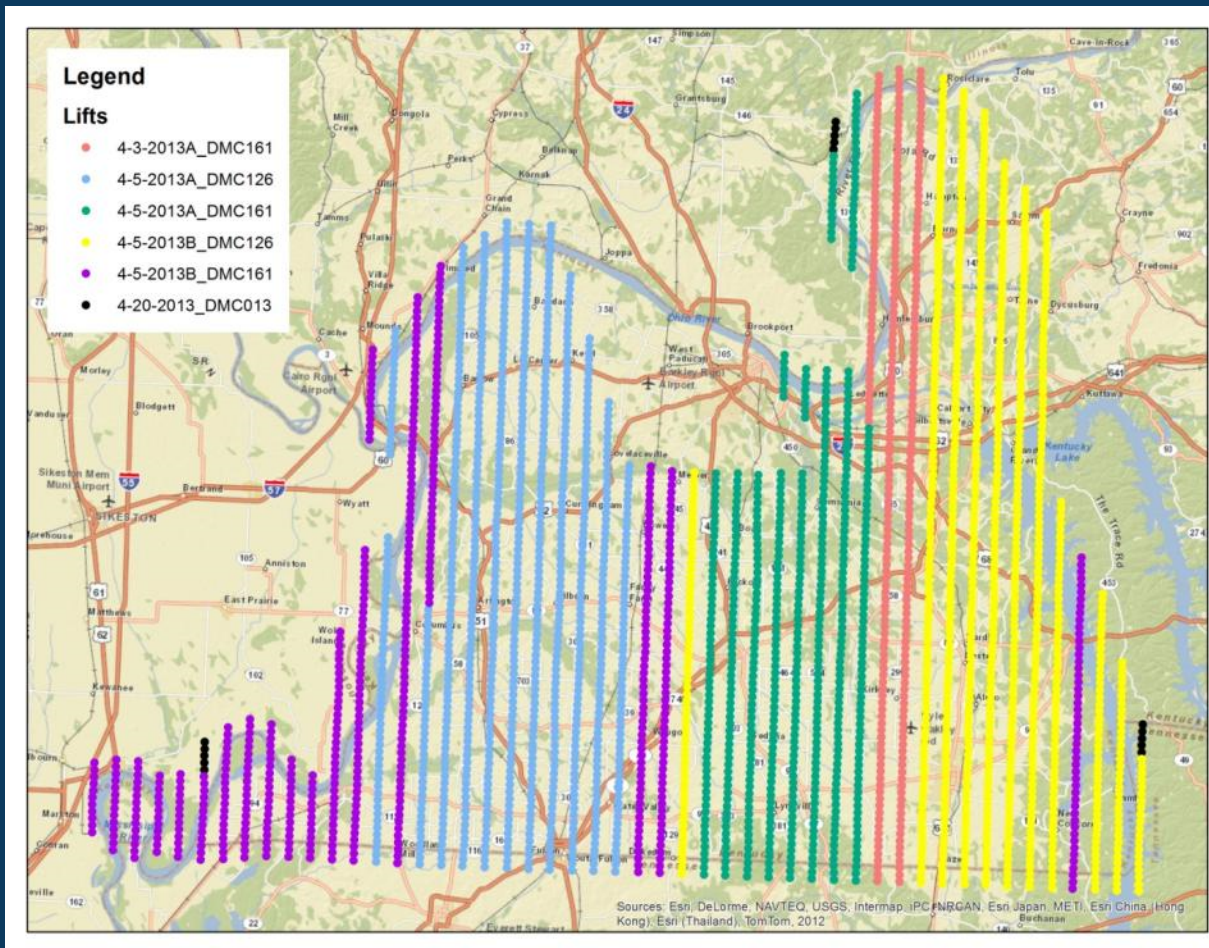
Post Flight Processing

- Initial processing
 - DMC workflow
- Color matching
 - Flight line to flight line and mission to mission
- QC

2013 McCracken 6" Flight Lines



2013 DMC 12" Flight Lines 3,164 Total Frames



PSI Image Checker

DMC Image Checker

File Settings Tools Help Choose Image Folder



KY Statewide (KYStatewide_Image Checker.mdb) Images: 1,536 To Check: 0

Flight Date: 3/11/2012 Initials: TSH

Accept (Y) Reject (N) Question (Q) Un-Set

Comments: Smoke (S) ResView

41 128	Accept	TSH
41 129	Accept	TSH
41 130	Accept	TSH
41 131	Accept	TSH
41 132	Accept	TSH
41 133	Accept	TSH
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41 143	Accept	TSH
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41 150	Accept	TSH
41 151	Accept	TSH
41 152	Accept	TSH
42 1	Accept	TSH
42 2	Accept	TSH
42 3	Accept	TSH
42 4	Accept	TSH
42 5	Accept	TSH
42 6	Accept	TSH
42 7	Accept	TSH
42 8	Accept	TSH
42 9	Accept	TSH
42 10	Accept	TSH



CIR

[Un-Set All Images](#)

Rejected Frame

DMC Image Checker



File Settings Tools Help Choose Image Folder KY Statewide (KYStatewide_Image Checker.mdb) Images: 1,026 To Check: 0

Flight Date 3/9/2012 Initials TSH

Accept (Y) Reject (N) Question (Q) Un-Set

Comments Cloudy (C)

50	50	Accept	TSH
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50	84	Accept	TSH



CIR
[Un-Set All Images](#)

FullView

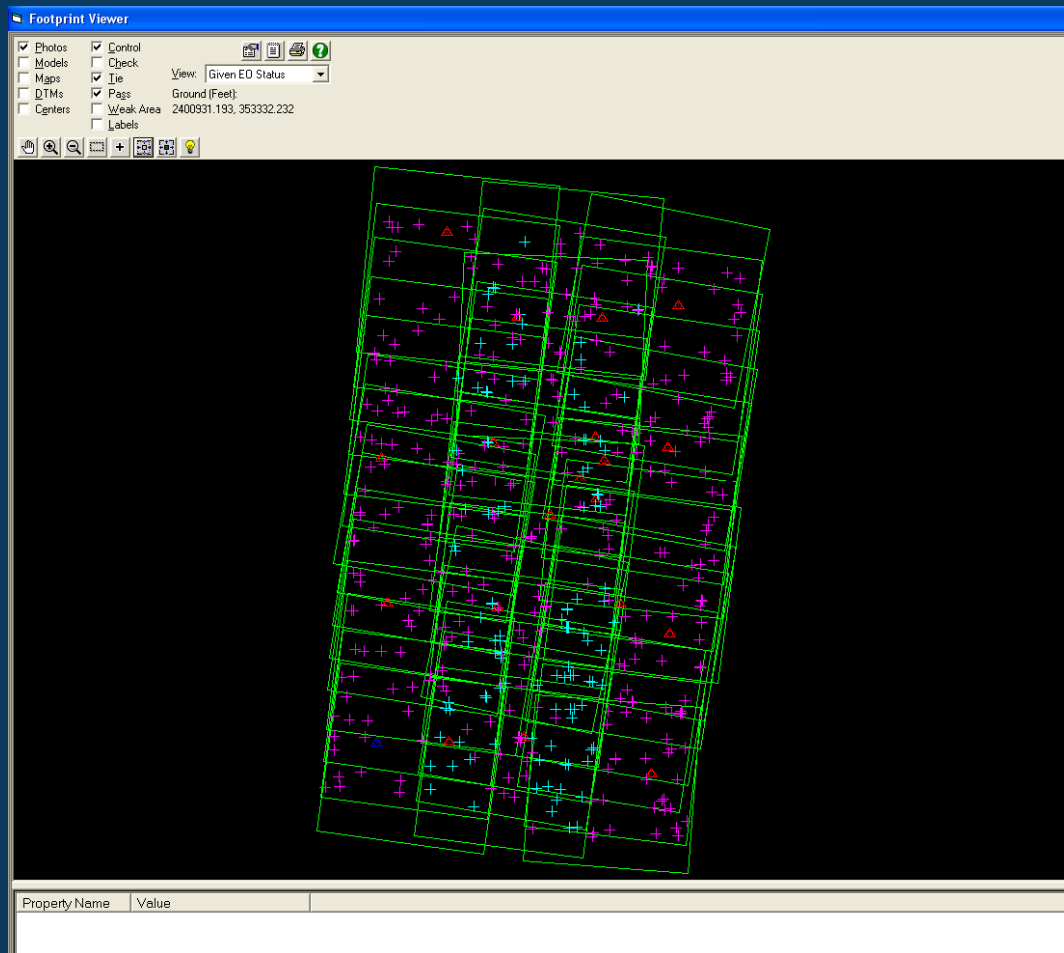
Flightline tone issues



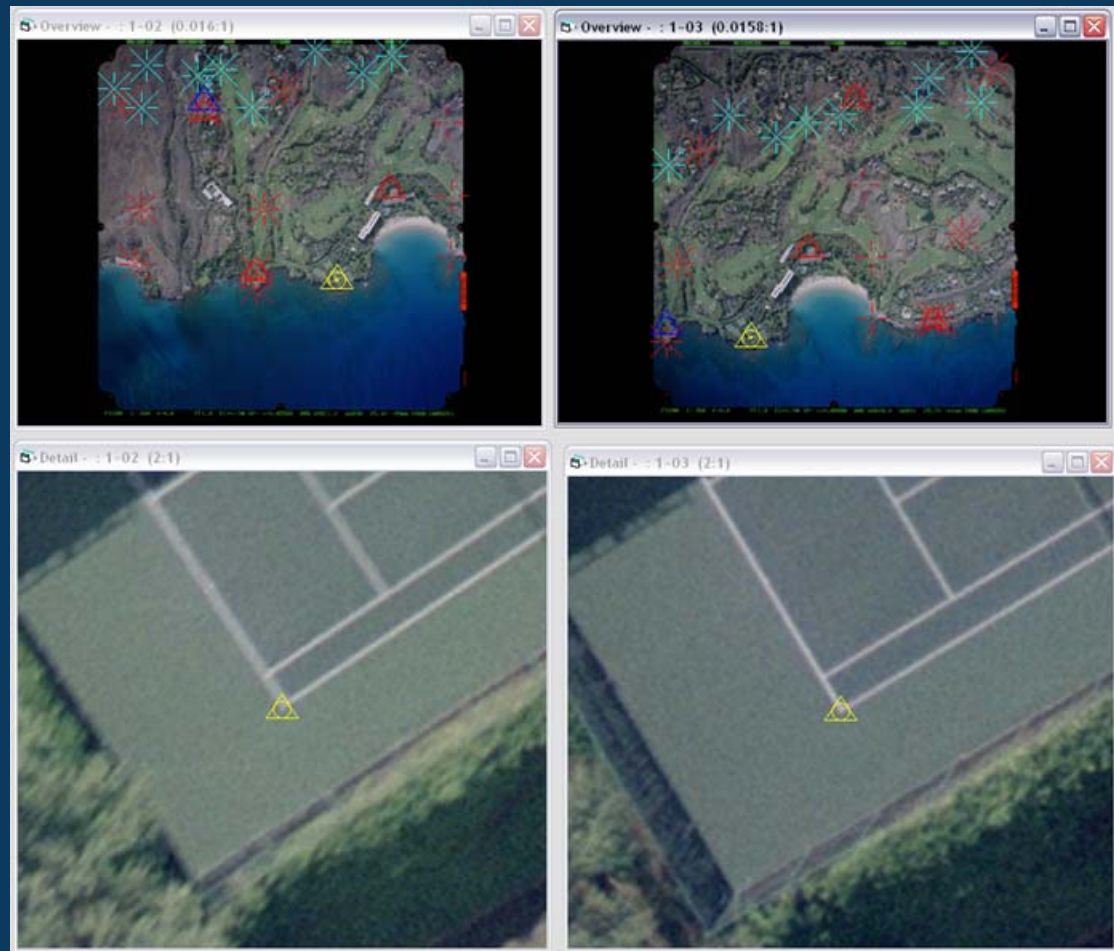
Ortho Production

- Control
- Aerial Triangulation (A/T)
- Surface
- Seamlines
- Mosaic
- Edits

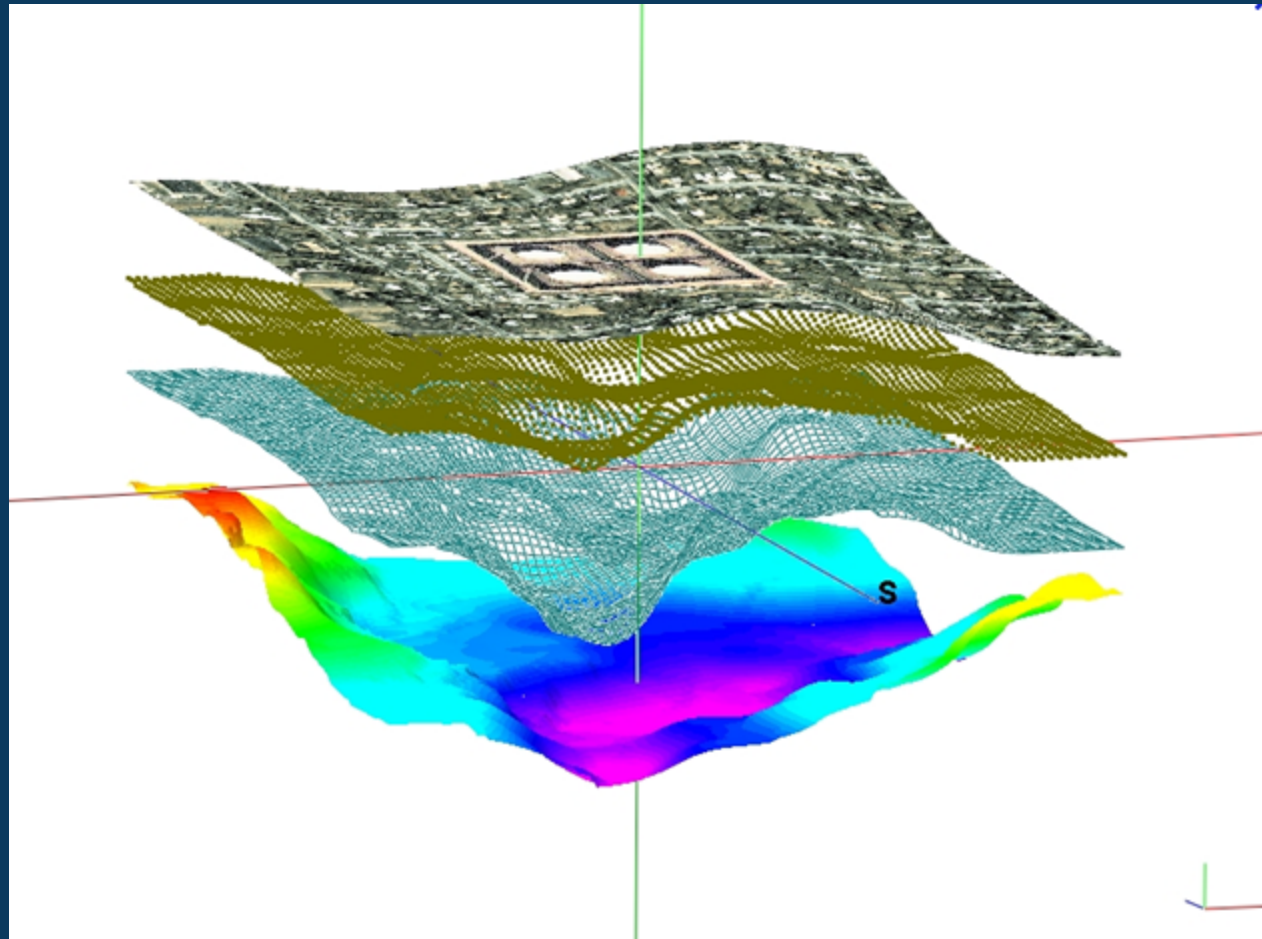
Aerial Triangulation



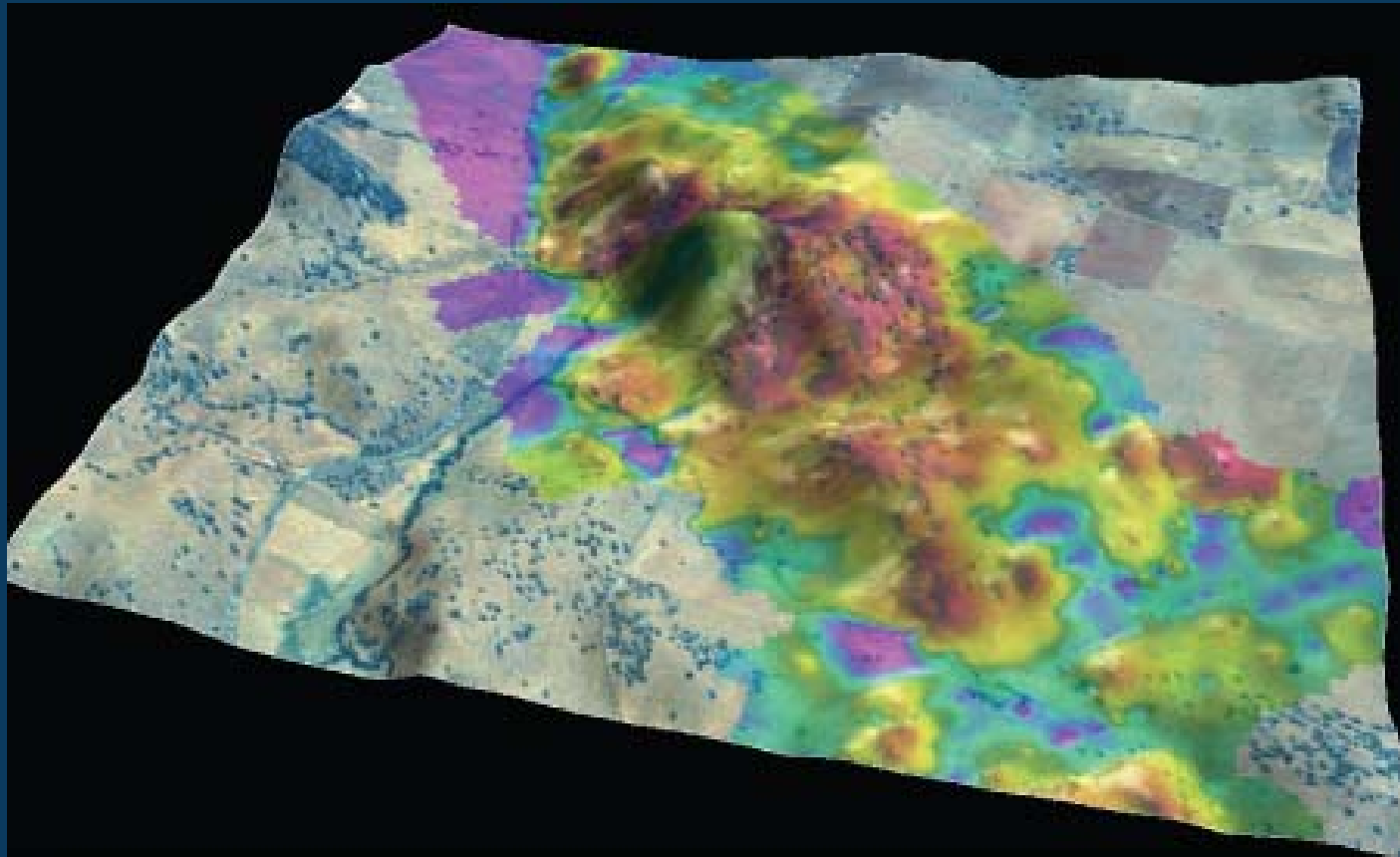
Tie Points



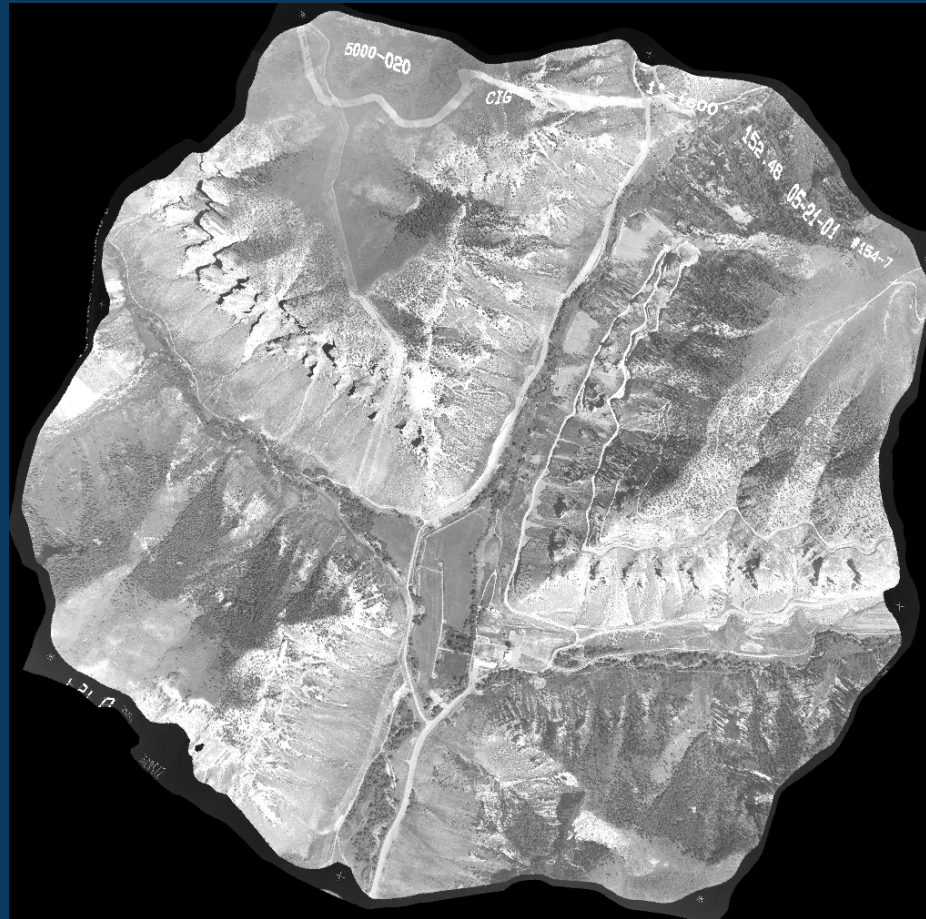
Layers of an Ortho



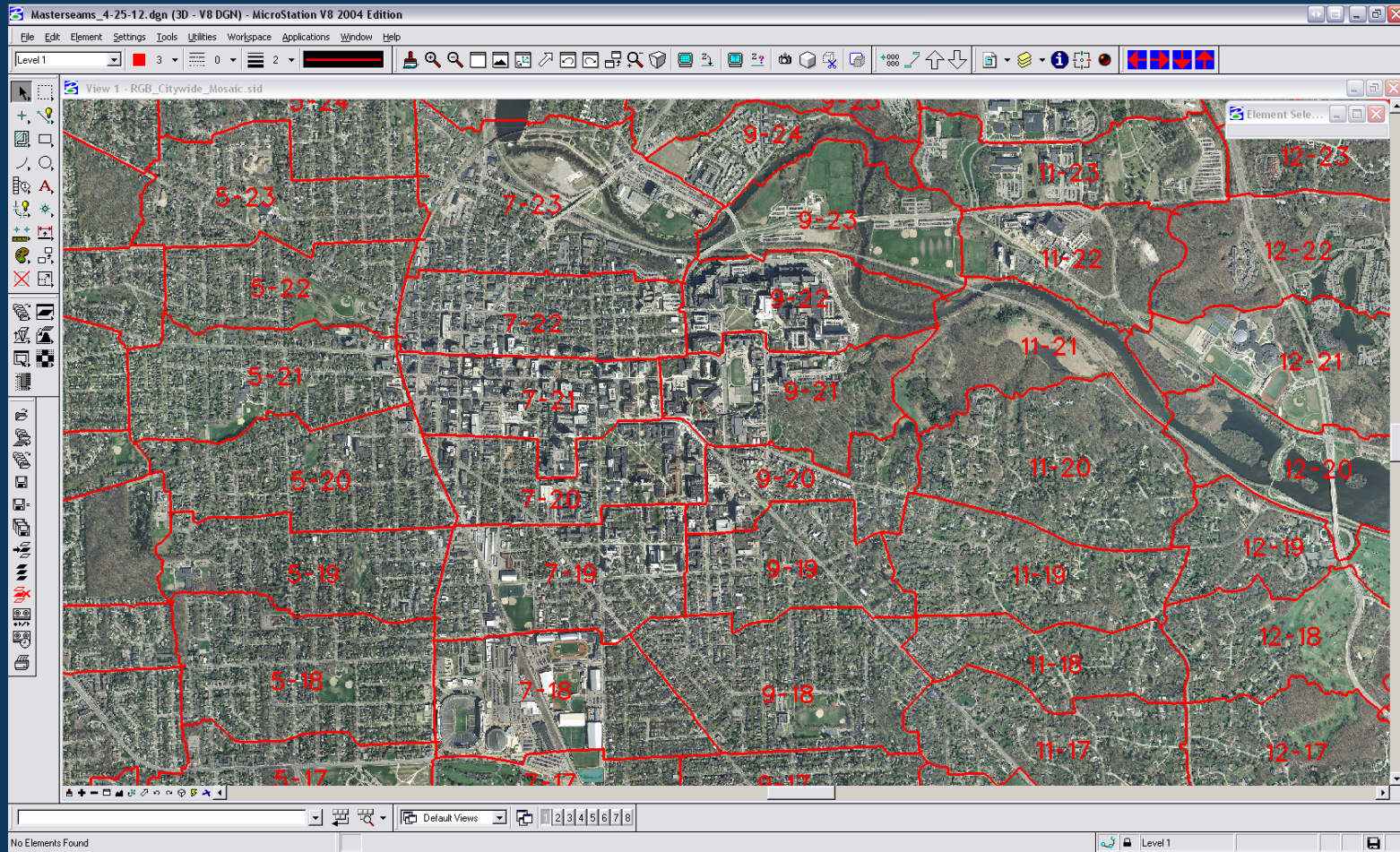
Ortho Image



Relief Displacement



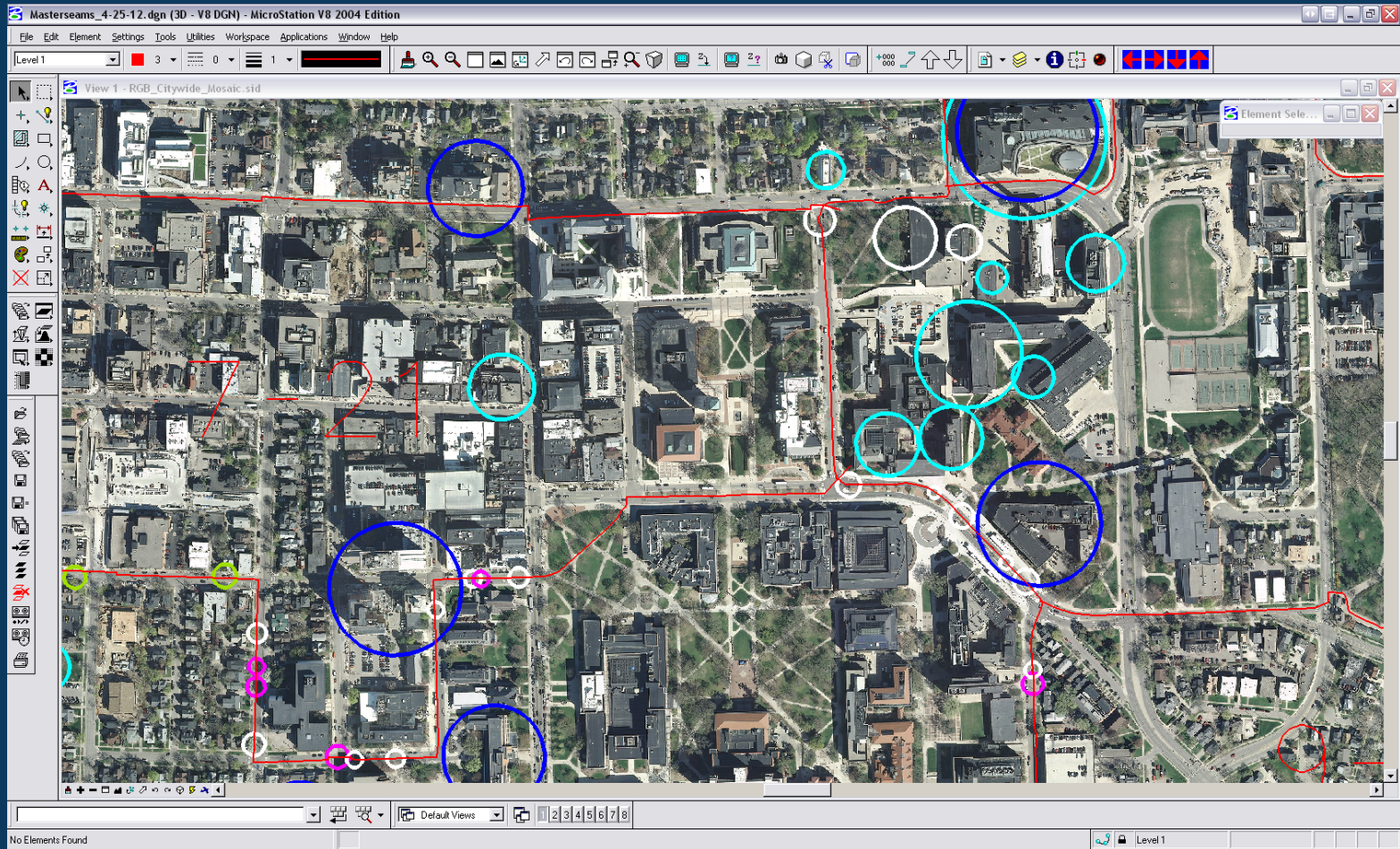
Seamlines



Frames to Mosaic



Tile QC



Offset



Wavy Bridge



Virtual On-line Inspection, Checking and Editing

VOICE

The screenshot displays the KY VOICE web application interface. At the top, the title bar reads "KY VOICE™ Virtual On-line Inspection, Checking & Editing". The main map area shows a satellite view of a region in Kentucky, with county names labeled: BALLARD, MADISON, LEE, MARSHALL, CALLOWAY, AVERES, LYON, CALDWELL, and TRIGAN. Major roads are marked with route numbers like 60, 62, 45, 641, 641X, 68, and 68X. The city of Paducah is also visible. On the left side, there is a navigation panel with a search bar and a review panel. The search panel includes fields for "Search layer" (set to "5K Tiles"), "Show" (set to "All"), "County" (set to "Ballard"), and "Imagename" (set to "N148E039"). The review panel has a section for "Update status of tile" with an "Image Number" field and a "Pass Tile - Review Complete" button. Below this is a "Create a QC call" section with instructions to "Select an issue type and draw a rectangle around the area of concern". Three issue types are listed with corresponding colored boxes: "Seamline Anomaly" (purple), "Elevation Anomaly" (orange), and "Image Anomaly" (green). The top right of the interface shows a "Data Layers" menu with options for "Streets", "KY Basemap", and "2013 Orth".

VOICE

KY VOICE™ Virtual On-line Inspection, Checking & Editing

Search layer: 5K Tiles
Show: All
County: Ballard
Imagename: N148E039
Search Clear

Review
Update status of tile
Image Number:
Pass Tile - Review Complete:
Create a QC call
Select an issue type and draw a rectangle around the area of concern

- Seamline Anomaly
- Elevation Anomaly
- Image Anomaly

Scale: 1:144,448
Latitude: 37.048751 Longitude: -88.606898

Data Layers: Streets KY Basemap 2013 Orth

Accuracy Report

PHOTO SCIENCE
Geospatial Solutions

accuracy analyst™
<http://www.spatialis.com>

Point PID-13: X1: 827495.784 Y1: 378271.876 X2: 827496.283 Y2: 378272.331 Delta X: 0.499 Delta Y: 0.456



Point PID-14: X1: 836375.707 Y1: 363984.248 X2: 836376.597 Y2: 363984.052 Delta X: 0.89 Delta Y: -0.195



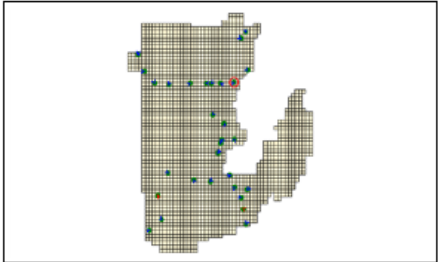
Report for 5748-006: Dade County
Accuracy Analyst: 6/15/2012 2:46:09 PM

16

PHOTO SCIENCE
Geospatial Solutions

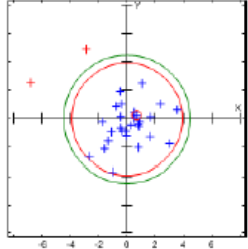
accuracy analyst™
<http://www.spatialis.com>

Vector Offset



Scaling Factor: 200

Circular Error



Error Statistics

Min ΔX:	-6.836	Min ΔY:	-3.668	SX:	1.954
Max ΔX:	3.537	Max ΔY:	4.864	SY:	1.696
Mean ΔX:	-0.122	Mean ΔY:	-0.163	SH:	1.825
Skew ΔX:	-1.183	Skew ΔY:	0.737		
RmseX:	1.925	RmseY:	1.676	RmseH:	2.552
SRMSE H:	0.333				
CE 90:	3.916	CE 95:	4.467	CI:	0.653
No. Observations:	30				
Horiz. Bias:	0.204		NSSDA: 4.406		

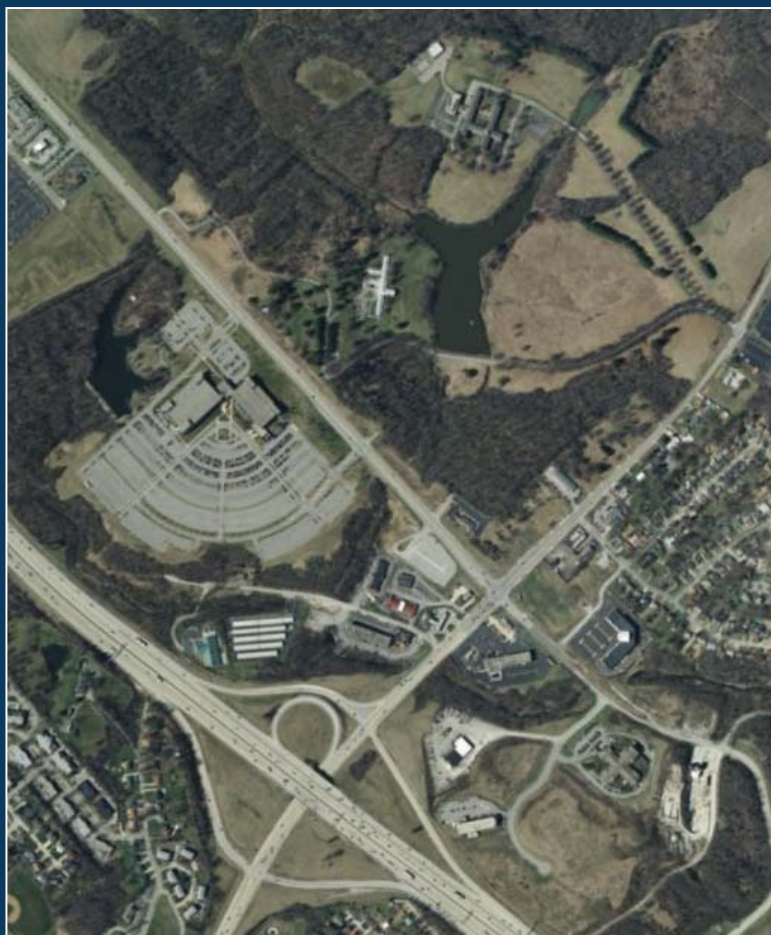
Report for 5748-006: Dade County
Accuracy Analyst: 6/15/2012 2:46:09 PM

2

Final Products

- Composites
- 3 band/4 band
- Compression
- Resampled datasets

RGB/CIR



Questions?

Thank You!

