

Data Compression

“From Sensor to Solution: Processing and Delivering
Massive UAS Geospatial Data”

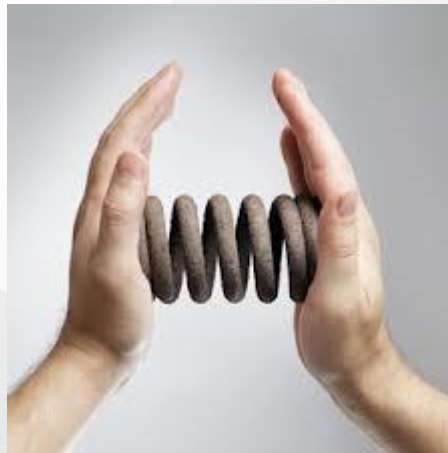
Jeff Young, Business Development

Genie Hays, Account Manager

Special Thanks to CompassData

Image Compression

Reduction of image data for efficient storage, transmission, viewing.....and exploitation.

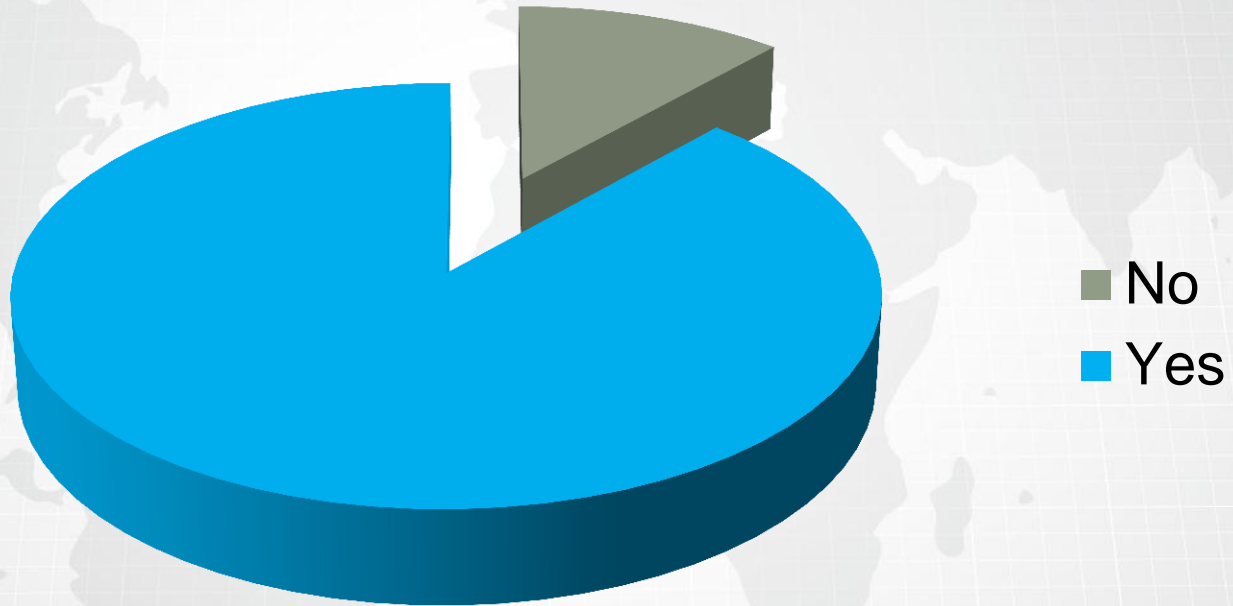


Today

- Thank you
- Advantageous use cases of compressed UAS datasets
- Practical compression ratios
- Data compression workflows
- Image compression examples



Do you plan to use a UAV?



Do you think compression will help manage UAV imagery?

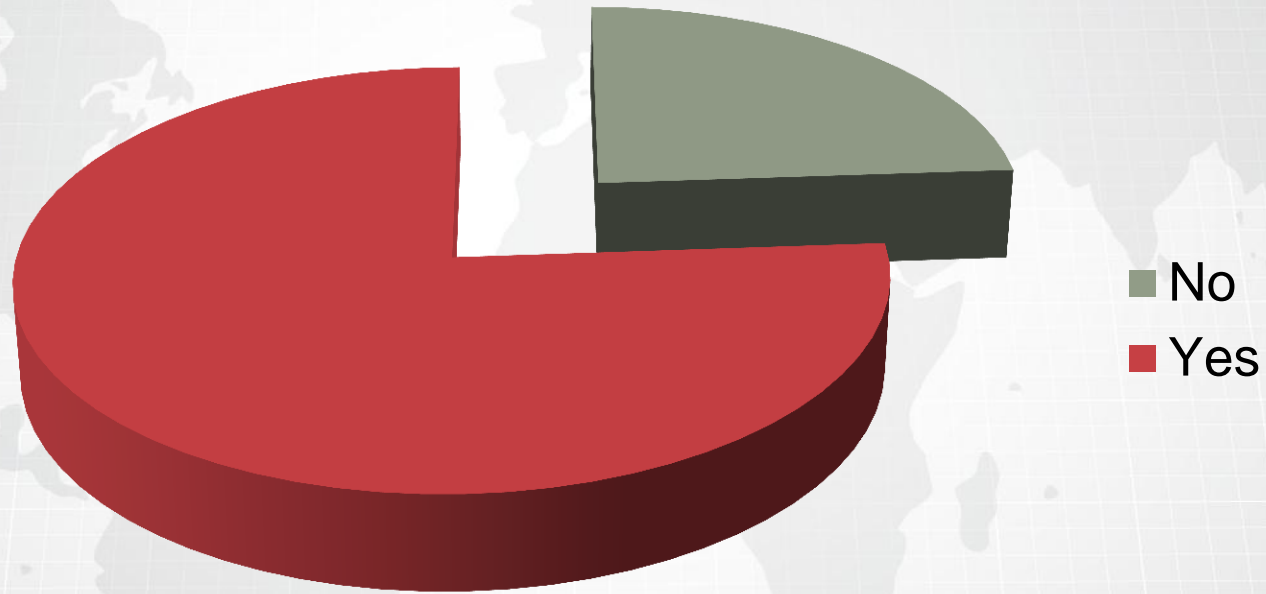


Image Data Compression – An Evolution

- Morse code (· · · — — — · · ·)
- Huffman coding – A predecessor to arithmetic encoding
- LZW – GIF (Graphics Interchange Format)
- Deflate – PNG (Portable Network Graphics)
- Run length encoding – BMP (aka bitmap image file)
- Arithmetic encoding – JPEG
- Wavelet transform – MrSID, ECW, and JPEG 2000

Why use Compression

- Personal workspace
- Local file system
- Over a network
- Application support
 - Natural Resources and Agriculture
 - Civil Government
 - Deployed War-Fighters
 - Humanitarian Initiatives
 - Commercial Interests
 - Others
 - Now.....self-guided image collectors

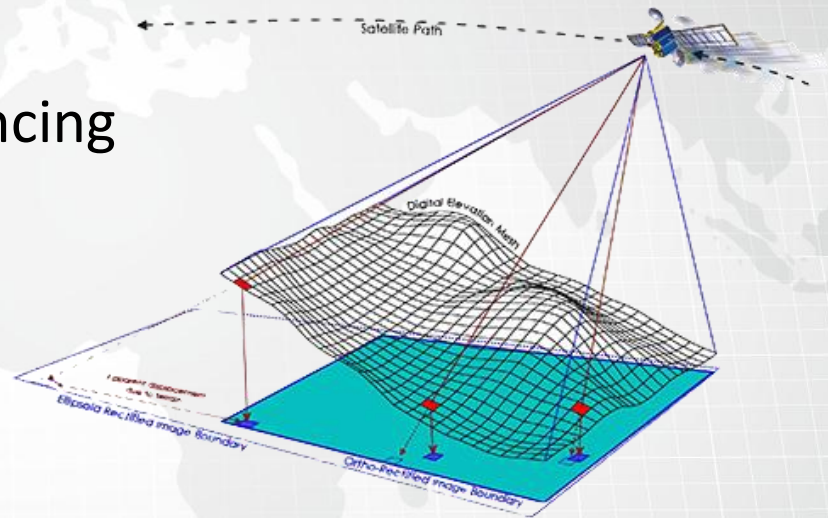


Compression Impact Factors (it's about time and space)

- File size
- Encoding time
- Decoding time
- Selective Decompression
- Area of interest compression
- Multispectral support – Now 255 Bands
- Streaming

Image Workflow

- Mission Planning
- Ground control points
- Acquisition
- Orthorectification/Georeferencing
- Compression
- QA
 - Precision
 - Accuracy
 - Completeness
 - Comparability
 - Representativeness
 -
 - Bias



Unmanned System?

GeoExpress 8.5 [Untitled*]

File Edit Images Options Tools Help

0 KB Data Cartridge 1 TB


Optimize Images Edit Metadata Despeckle Images Mosaics Updates

Total: 17 Selected: 1

- 2014-10-20_jmy_survey_pin.sid
- 2014-10-20_jmy_survey_pin_10240_1.sid
- 2014-10-20_jmy_survey_pin_1280_1.sid
- 2014-10-20_jmy_survey_pin_160_1.sid
- 2014-10-20_jmy_survey_pin_20480_1.sid
- 2014-10-20_jmy_survey_pin_2560_1.sid
- 2014-10-20_jmy_survey_pin_320_1.sid
- 2014-10-20_jmy_survey_pin_40_1.sid
- 2014-10-20_jmy_survey_pin_5120_1.sid
- 2014-10-20_jmy_survey_pin_640_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- 2014-10-20_jmy_survey_pin_lossless.sid
- egypt_portfouad_wv2_msi_march2_2020
- jmyoung_house_modified_1.sid
- mallard1_700to1.sid
- Seneca SR 587 3.69 PID 86958_orthomo
- Toussaint_UAS Sample 1.7GB.sid

Scale: 1:1

Preview output image with target encoding options at 1:1 resolution



X Coord: 434633 Y Coord: 3457703

Encode Selected Images

Properties Output Preview



Navigation toolbar with icons for Home, Pan, Zoom In, Zoom Out, Rotate, Refresh, and Scale. A slider indicates a zoom level of 1.6%. The LIZARDTECH logo is visible on the right.

Layer list panel showing a checked 'Group' containing a checked layer named 'mallard1_700to1.sid'.

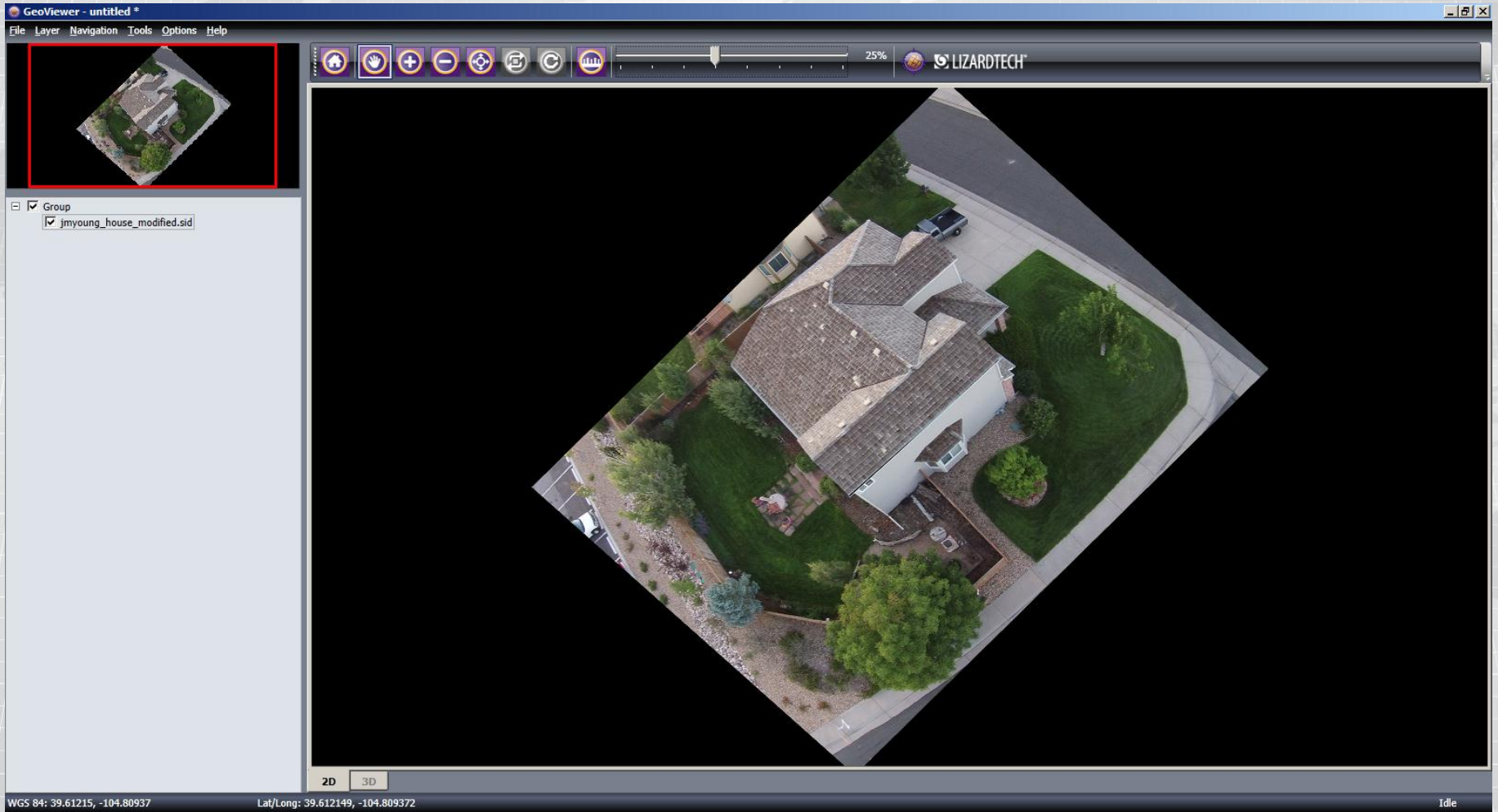


2D 3D

GeoViewer



Geo-Referenced



Geo-Referenced

The screenshot displays the GeoExpress 8.5 software interface. The title bar reads "GeoExpress 8.5 [Untitled*]". The menu bar includes "File", "Edit", "Images", "Options", "Tools", and "Help". The toolbar contains various icons for file operations and image processing. In the top right corner, a status bar shows "0 KB Data Cartridge 1 TB".

The main interface is divided into several panels:

- Image Properties:** Displays metadata for the selected image.

Input File Size:	5.3 MB	File Type:	MrSID Generation 4
Input Image Size:	26.8 MB	Bands:	4
Image Width:	3167 pixels	Data Type:	8 bits, unsigned
Image Height:	2954 pixels		
Coordinate Reference System:	WGS 84 (4326)		
- Image Extents:** Displays the spatial coordinates of the image.

Left:	-104.80934191	X Resolution:	0.00000017
Top:	39.61216874	Y Resolution:	-0.00000017
Right:	-104.80879249		
Bottom:	39.61165627		
- Encode Options:** Configures the output of the encoding process.

Output Format:	MrSID Generation 4	More Encode Options...	
Output Target:	File		
Output File:	C:\Users\jyoung\Desktop\UASReno\jmyoung_house_modi	Browse...	
Compression Method:	Compression Ratio	20 :1	<input type="checkbox"/> Lossless
Alpha Options...			<input type="checkbox"/> Encode As Test Image
Target File Size:	1.3 MB	Estimated Memory Usage:	13.3 MB
- Image List:** A list of 15 images, with "jmyoung_house_modified.sid" selected.

At the bottom of the interface, there are buttons for "Encode Selected Images", "Properties", "Output", and "Preview".

Field Survey



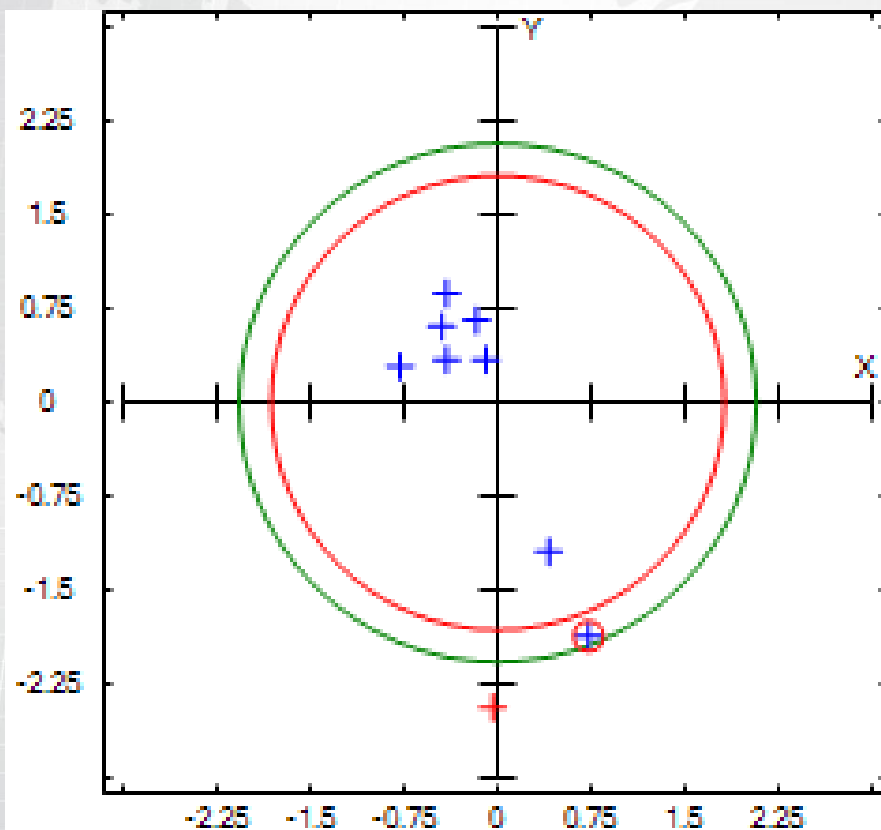


- Project Information
- Prepared By: CompassAA User
- Project Name: Jeff Young Residence
- Sensor Info: UAV (Hobbyist)
- Sensor Resolution: 10
- Vendor Name: Unknown
- Date of Acquisition: Start: 10/1/2014 Finish: 10/1/2014





- Circular Error



Error Statistics

Min ΔX : -0.781
Min ΔY : -2.434
Max ΔX : 0.727
Max ΔY : 0.873
Mean ΔX : -0.135
Mean ΔY : -0.263
Rmse X: 0.458
Rmse Y: 1.189
Rmse H: 1.274
CE 90: 1.817
CE 95: 2.072
No. Obs.: 9
NSSDA: 2.204

Understanding Error



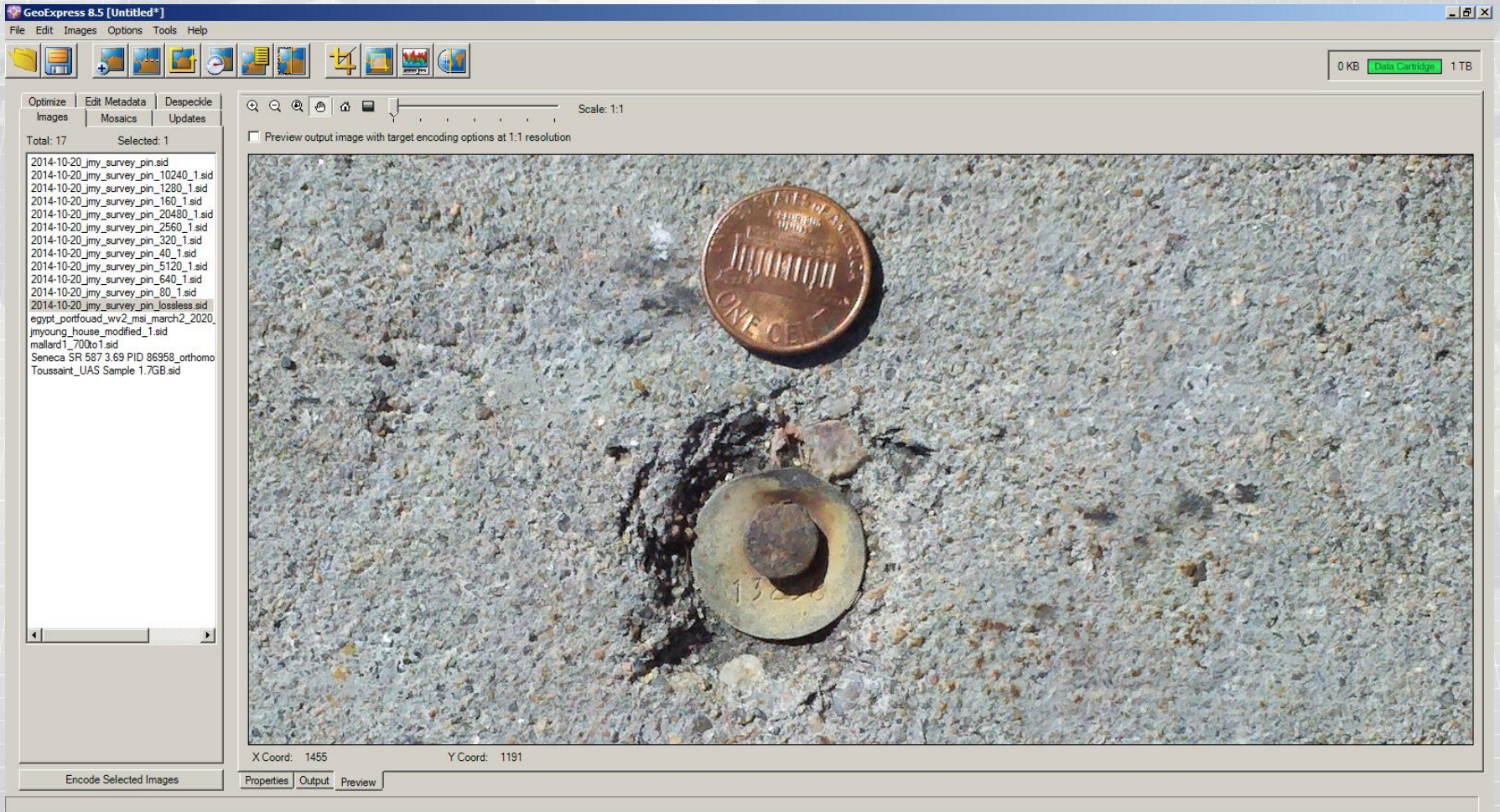
Understanding Error



Ground Control



Lossless



20:1

GeoExpress 8.5 [Untitled*]

File Edit Images Options Tools Help


0 KB Data Cartridge 1 TB

Optimize Edit Metadata Despeckle
Images Mosaics Updates

Total: 17 Selected: 1

- 2014-10-20_jmy_survey_pin.sid
- 2014-10-20_jmy_survey_pin_10240_1.sid
- 2014-10-20_jmy_survey_pin_1280_1.sid
- 2014-10-20_jmy_survey_pin_160_1.sid
- 2014-10-20_jmy_survey_pin_20480_1.sid
- 2014-10-20_jmy_survey_pin_2560_1.sid
- 2014-10-20_jmy_survey_pin_320_1.sid
- 2014-10-20_jmy_survey_pin_40_1.sid
- 2014-10-20_jmy_survey_pin_5120_1.sid
- 2014-10-20_jmy_survey_pin_640_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- egypt_portfouad_wv2_msi_march2_2020_jmyoung_house_modified_1.sid
- mallard_1_700to1.sid
- Seneca SR 587 3.69 PID 86958_orthomo
- Toussaint_UAS Sample 1.7GB.sid

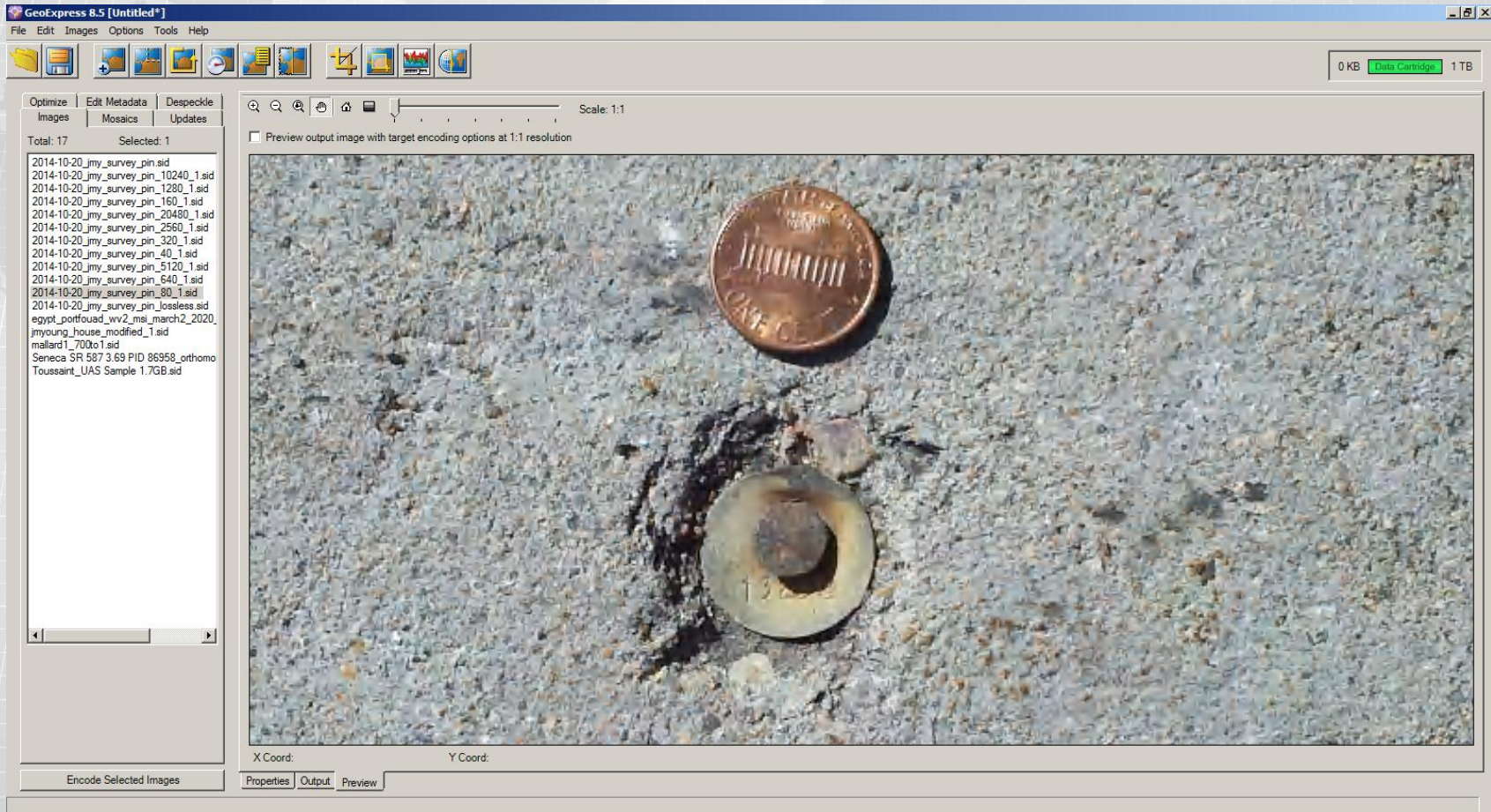
Preview output image with target encoding options at 1:1 resolution



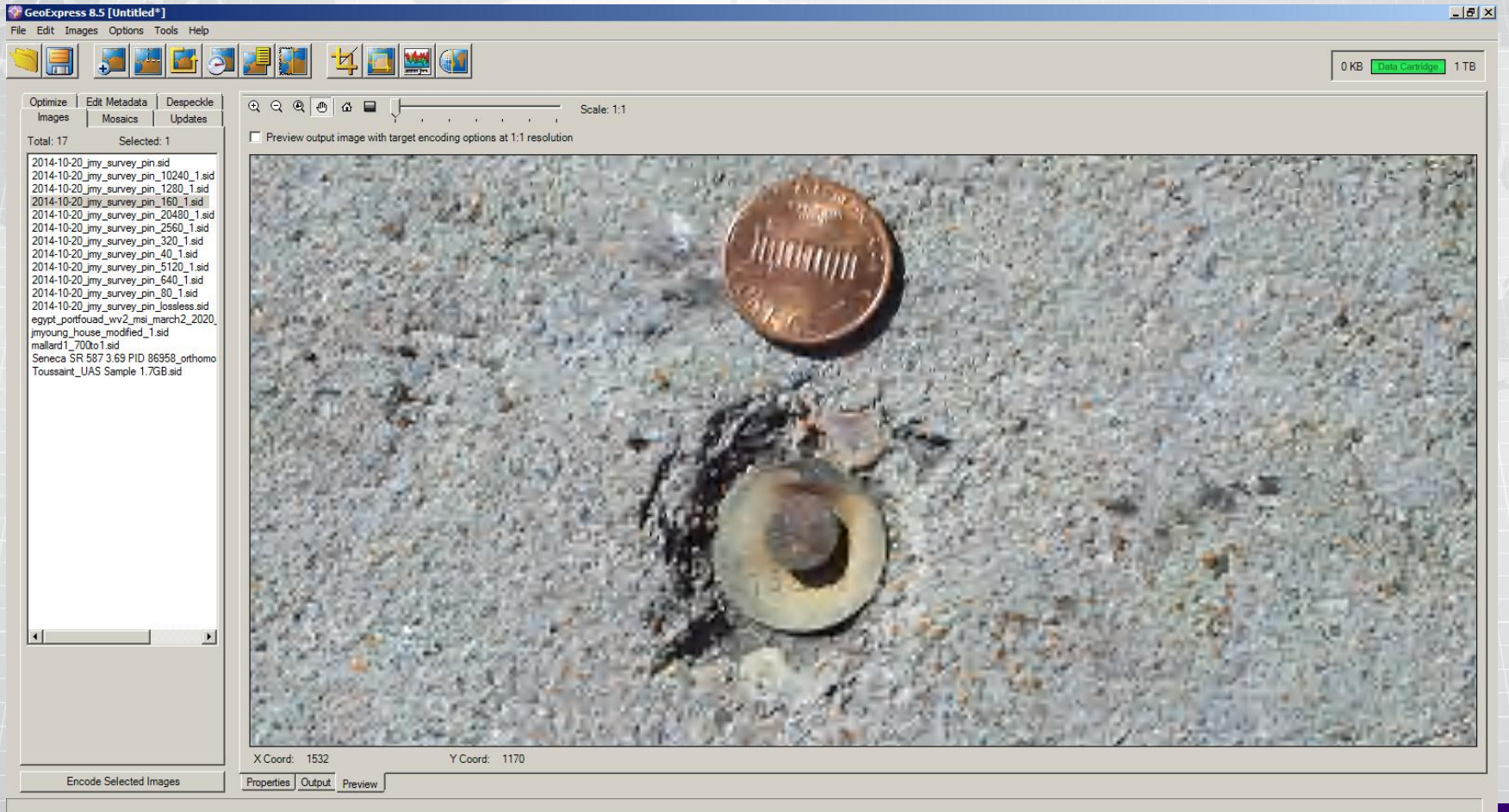
X Coord: 1314 Y Coord: 993

Encode Selected Images Properties Output Preview

80:1



160:1



320:1

GeoExpress 8.5 [Untitled*]

File Edit Images Options Tools Help

0 KB Data Cartridge 1 TB


Optimize Edit Metadata Despeckle
Images Mosaics Updates

Total: 17 Selected: 1

- 2014-10-20_jmy_survey_pin.sid
- 2014-10-20_jmy_survey_pin_10240_1.sid
- 2014-10-20_jmy_survey_pin_1280_1.sid
- 2014-10-20_jmy_survey_pin_160_1.sid
- 2014-10-20_jmy_survey_pin_20480_1.sid
- 2014-10-20_jmy_survey_pin_2560_1.sid
- 2014-10-20_jmy_survey_pin_320_1.sid
- 2014-10-20_jmy_survey_pin_40_1.sid
- 2014-10-20_jmy_survey_pin_5120_1.sid
- 2014-10-20_jmy_survey_pin_640_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- 2014-10-20_jmy_survey_pin_lossless.sid
- egypt_portfouad_wv2_msi_march2_2020
- jmyoung_house_modified_1.sid
- mallard1_700to1.sid
- Seneca SR 587 3.69 PID 86958_orthomo
- Toussaint_UAS Sample 1.7GB.sid

Scale: 1:1

Preview output image with target encoding options at 1:1 resolution



X Coord: 1679 Y Coord: 1160

Encode Selected Images

Properties Output Preview

640:1

GeoExpress 8.5 [Untitled*]

File Edit Images Options Tools Help

0 KB Data Cartridge 1 TB


Optimize Edit Metadata Despeckle
Images Mosaics Updates

Total: 17 Selected: 1

- 2014-10-20_jmy_survey_pin.sid
- 2014-10-20_jmy_survey_pin_10240_1.sid
- 2014-10-20_jmy_survey_pin_1280_1.sid
- 2014-10-20_jmy_survey_pin_160_1.sid
- 2014-10-20_jmy_survey_pin_20480_1.sid
- 2014-10-20_jmy_survey_pin_2560_1.sid
- 2014-10-20_jmy_survey_pin_320_1.sid
- 2014-10-20_jmy_survey_pin_40_1.sid
- 2014-10-20_jmy_survey_pin_5120_1.sid
- 2014-10-20_jmy_survey_pin_640_1.sid
- 2014-10-20_jmy_survey_pin_80_1.sid
- 2014-10-20_jmy_survey_pin_lossless.sid
- egypt_portfouad_wv2_msi_march2_2020
- jmyoung_house_modified_1.sid
- mallard1_700to1.sid
- Seneca SR 587 3.69 PID 86958_orthomo
- Toussaint_UAS Sample 1.7GB.sid

Scale: 1:1

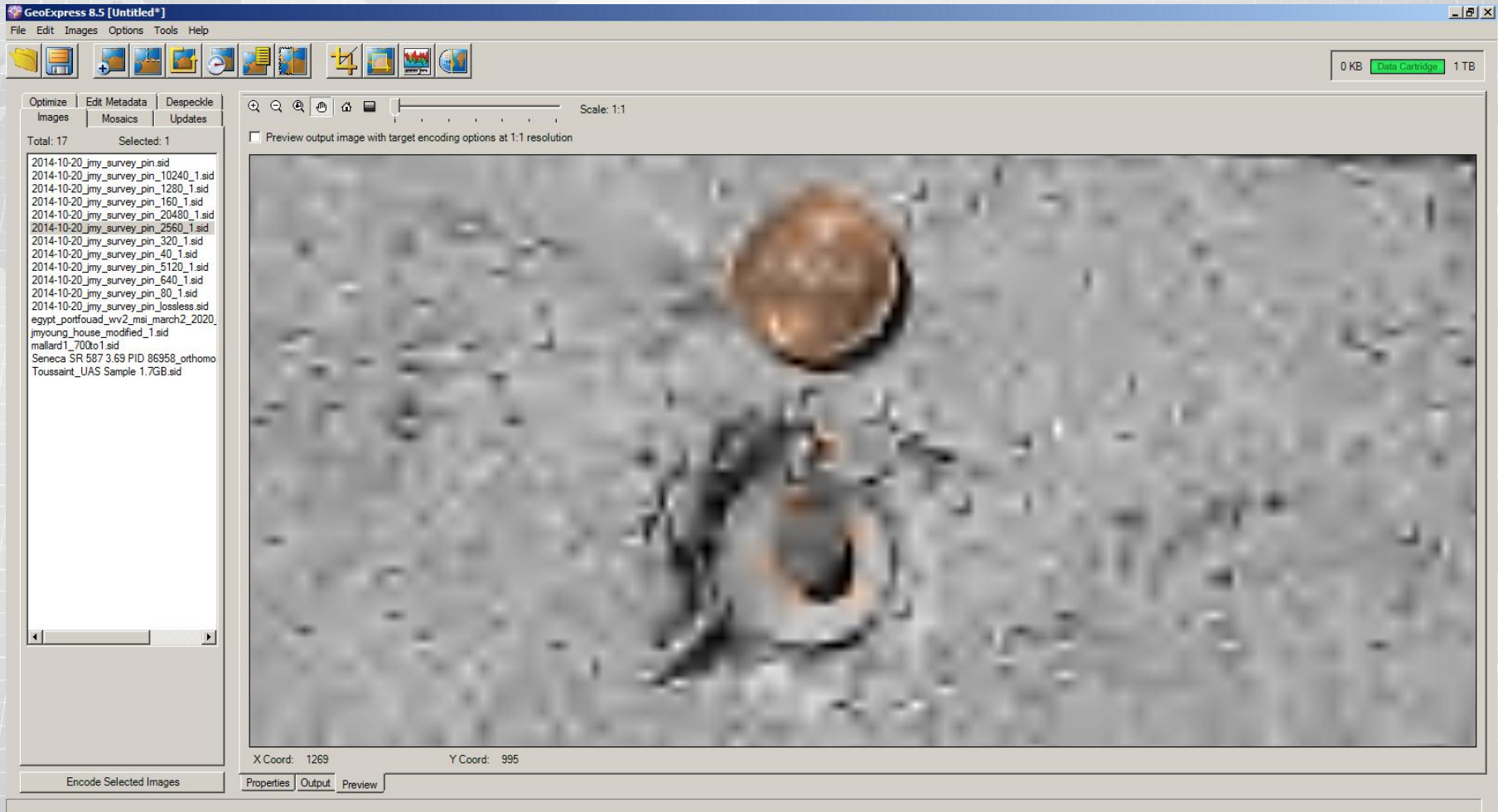
Preview output image with target encoding options at 1:1 resolution



X Coord: 1271 Y Coord: 979

Encode Selected Images Properties Output Preview

2560:1



10240:1

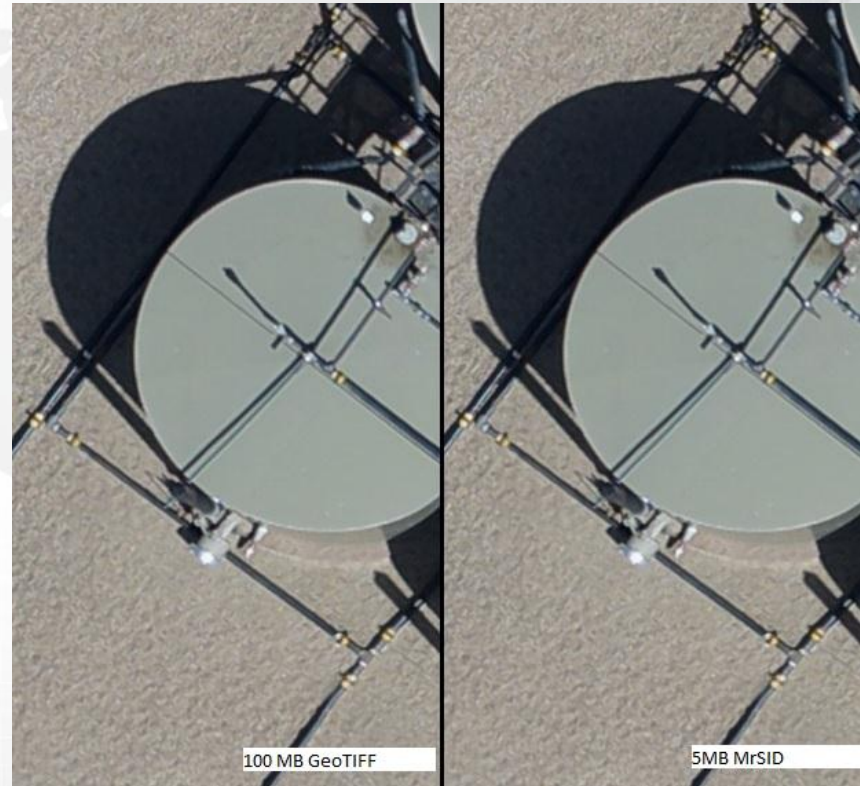
The screenshot shows the GeoExpress 8.5 software interface. The title bar reads "GeoExpress 8.5 [Untitled*]". The menu bar includes "File", "Edit", "Images", "Options", "Tools", and "Help". The toolbar contains various icons for file operations and image processing. The status bar at the top right shows "0 KB Data Cartridge 1 TB".

The main interface is divided into several sections:

- Optimize | Edit Metadata | Despeckle**: A tabbed menu for image processing options.
- Images | Mosaics | Updates**: A sub-menu for image management.
- Total: 17 Selected: 1**: A summary of the image list.
- Image List**: A list of image files, including:
 - 2014-10-20_jmy_survey_pin.sid
 - 2014-10-20_jmy_survey_pin_10240_1.sid
 - 2014-10-20_jmy_survey_pin_1280_1.sid
 - 2014-10-20_jmy_survey_pin_160_1.sid
 - 2014-10-20_jmy_survey_pin_20480_1.sid
 - 2014-10-20_jmy_survey_pin_2560_1.sid
 - 2014-10-20_jmy_survey_pin_320_1.sid
 - 2014-10-20_jmy_survey_pin_40_1.sid
 - 2014-10-20_jmy_survey_pin_5120_1.sid
 - 2014-10-20_jmy_survey_pin_640_1.sid
 - 2014-10-20_jmy_survey_pin_80_1.sid
 - 2014-10-20_jmy_survey_pin_lossless.sid
 - egypt_portfouad_vv2_msi_march2_2020
 - jmyoung_house_modified_1.sid
 - mallard1_700to1.sid
 - Seneca SR 587 3.69 PID 86958_orthomo
 - Toussaint_UAS Sample 1.7GB.sid
- Preview Window**: A large window showing a blurry image of a person holding a yellow measuring tape. The image is heavily blurred, making details difficult to discern. The person is wearing a brown hat and a dark jacket. The measuring tape is yellow with black markings.
- Scale: 1:2**: A zoom control for the preview window.
- Preview output image with target encoding options at 1:1 resolution**: A checkbox option.
- X Coord: 1876 Y Coord: 1235**: Coordinates for the current view.
- Properties | Output | Preview**: A tabbed menu for the preview window.
- Encode Selected Images**: A button at the bottom left of the interface.

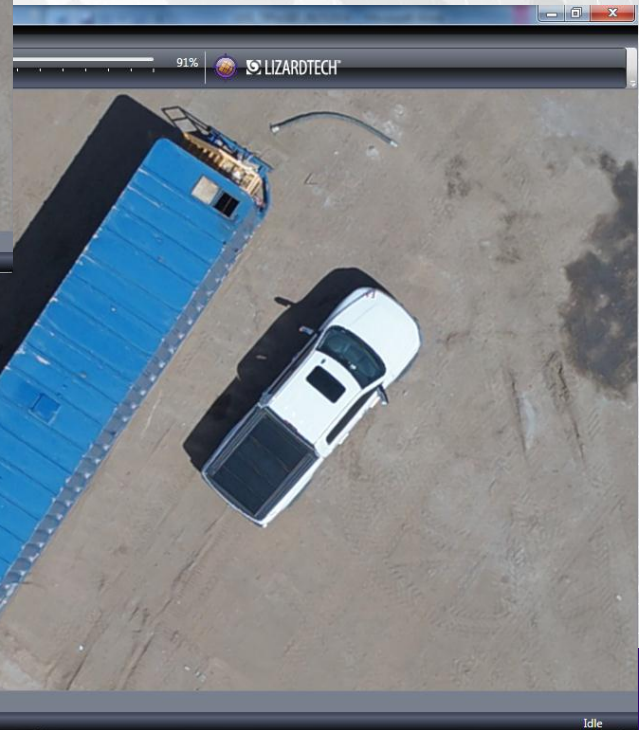
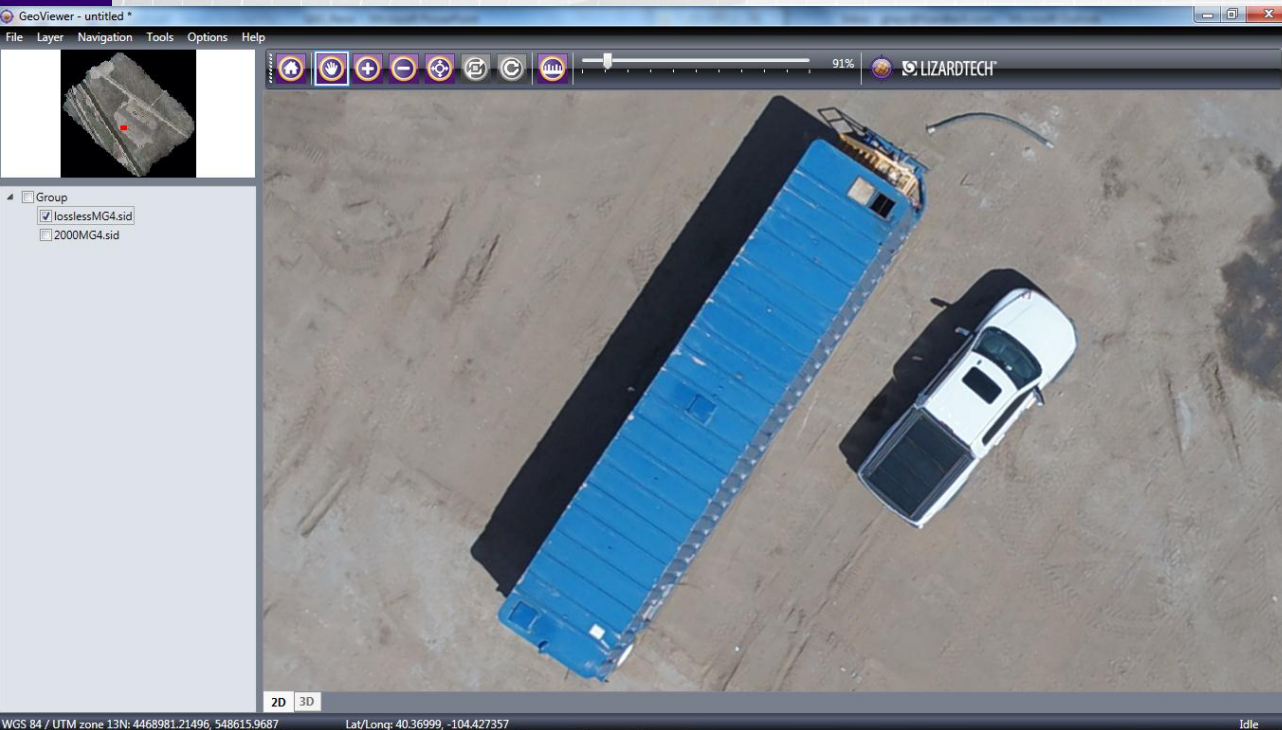
Image Compression

- Will I lose data?
- Will there be distortion?
- Will I have to decompress?



Compression ratios

3.04 GB TIFF

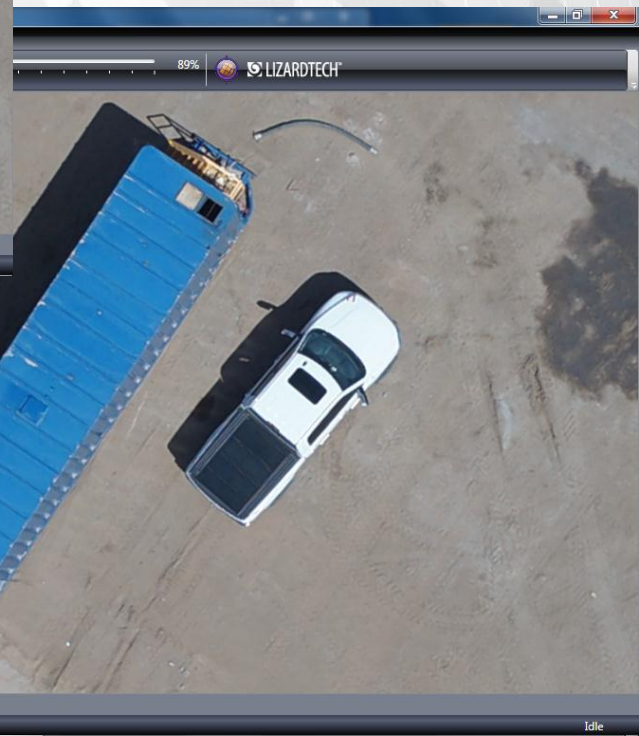
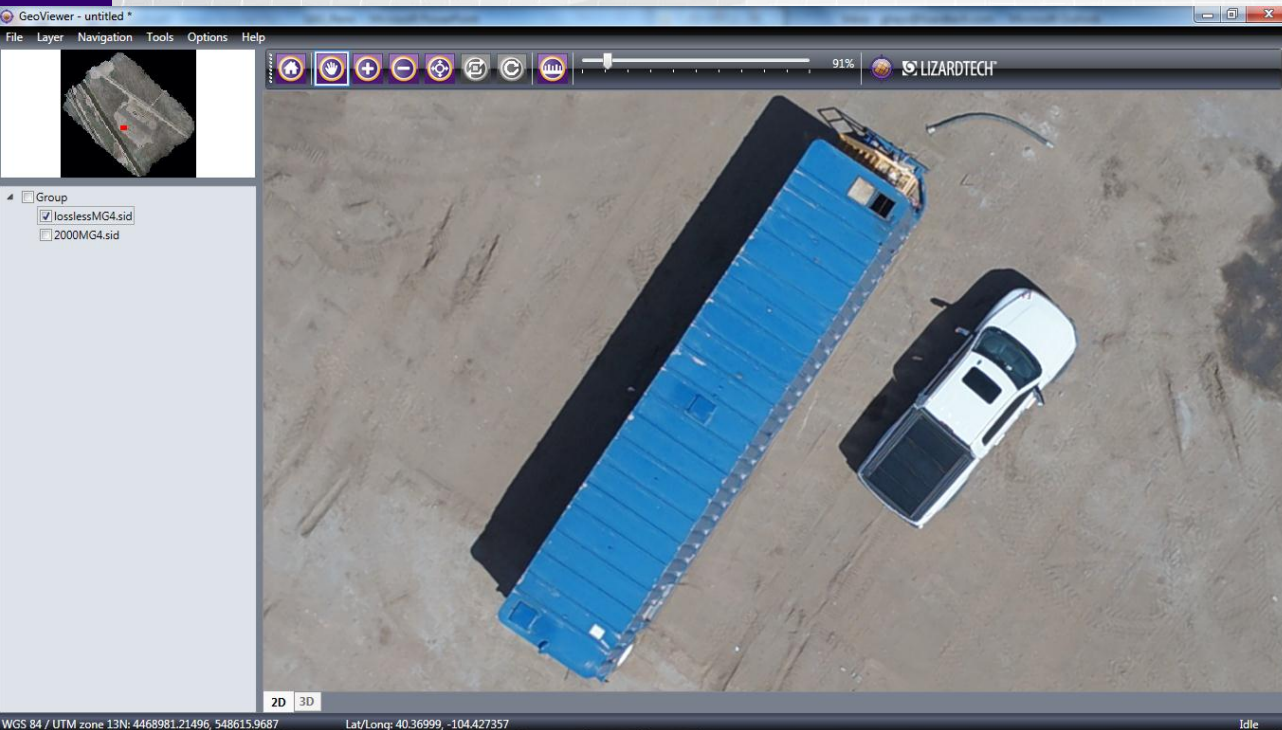


Lossless 2:1
451.8 MB

- 2000MG4.sid
- 900MG3.sid
- 800MG4.sid
- 800MG3.sid
- 700MG4.sid
- 600MG4.sid
- 500MG4.sid
- 400MG4.sid
- 300MG4.sid
- 200MG4.sid
- 100MG4.sid
- 90MG4.sid
- 80MG4.sid
- 70MG4.sid
- 60MG4.sid
- 50MG4.sid
- 40MG4.sid
- 30MG4.sid
- 20MG4.sid
- 10MG4.sid
- losslessMG4.sid
- 2000MG4.sid

Compression ratios

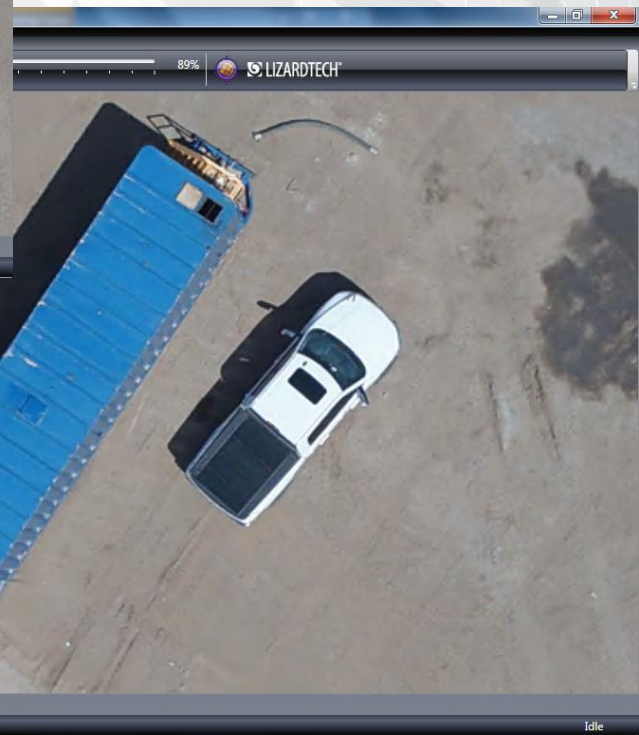
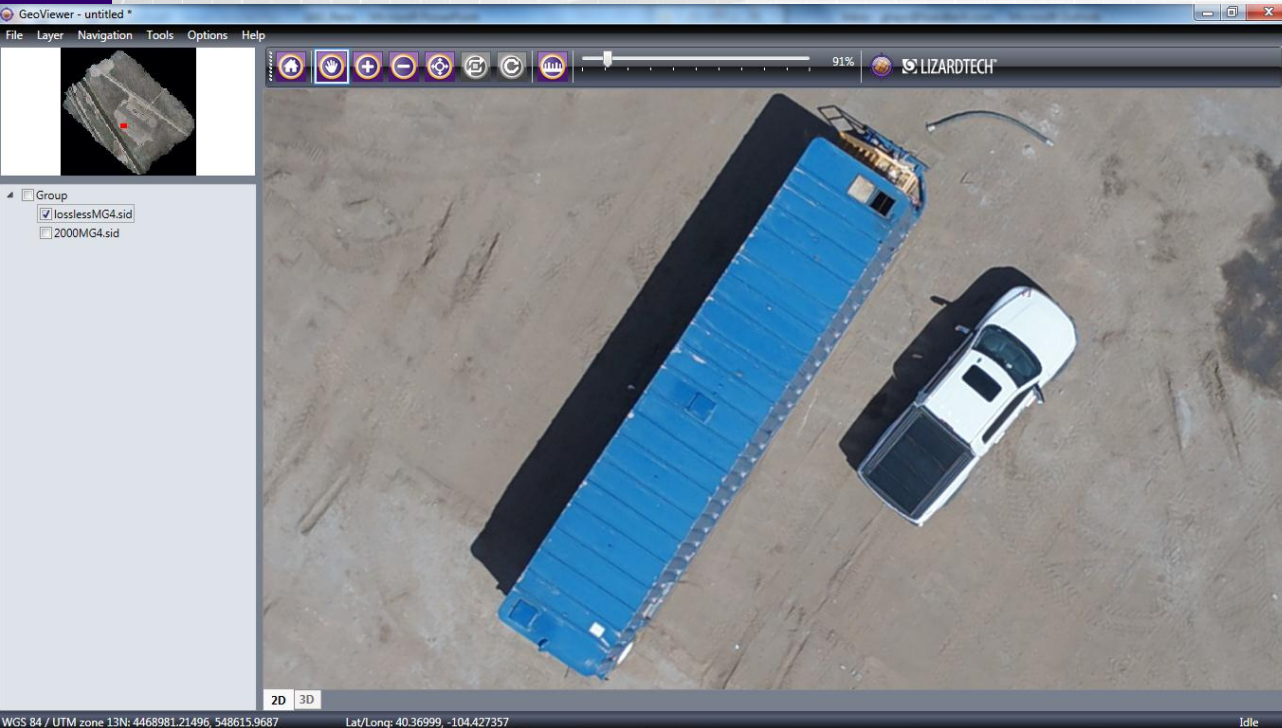
3.04 GB TIFF



Lossy 20:1
114 MB

Compression ratios

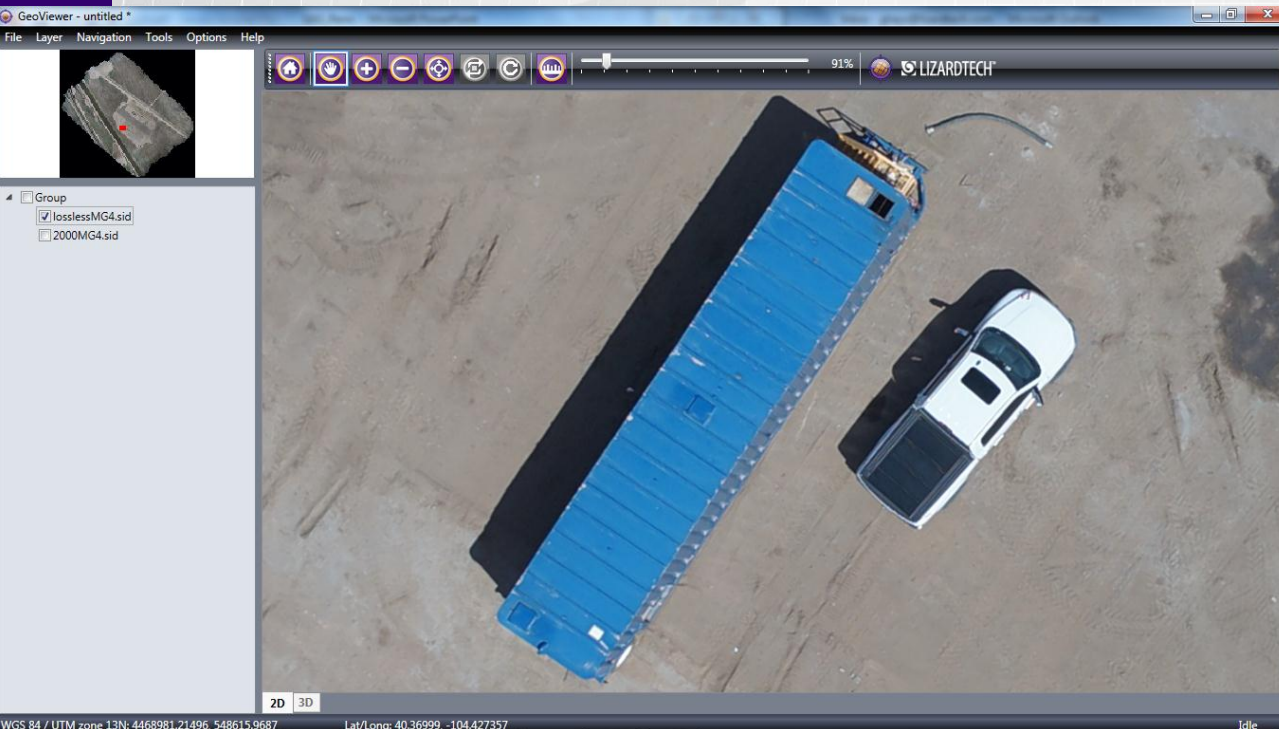
3.04 GB TIFF



Lossy 100:1
22.8 MB

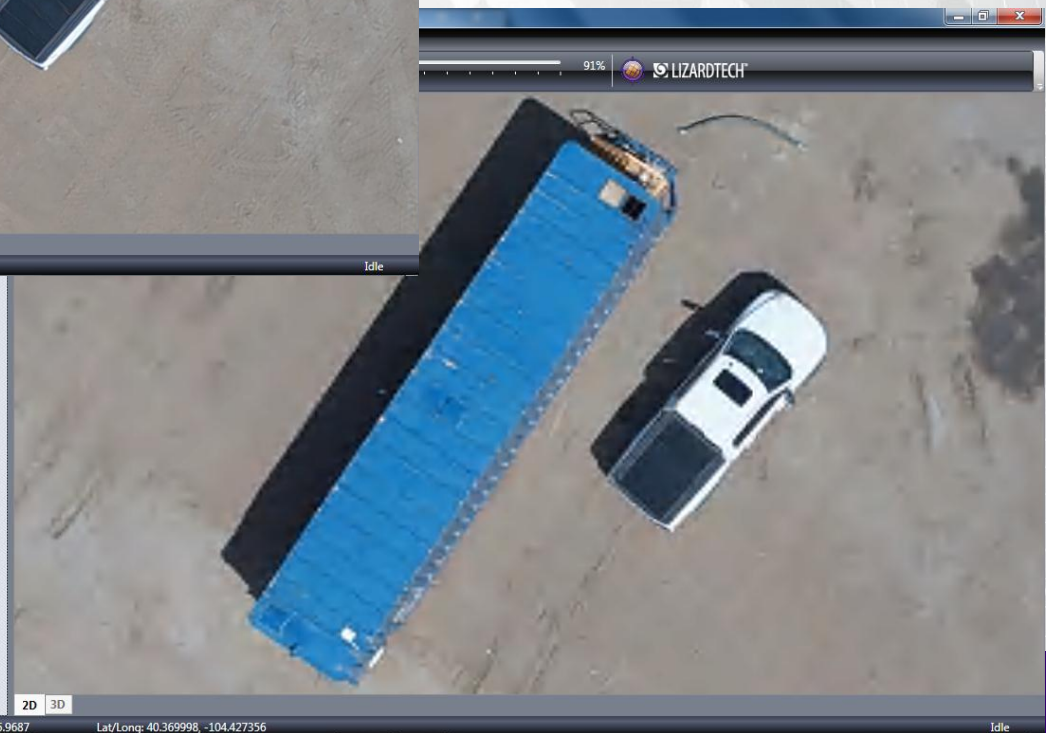
Compression ratios

3.04 GB TIFF



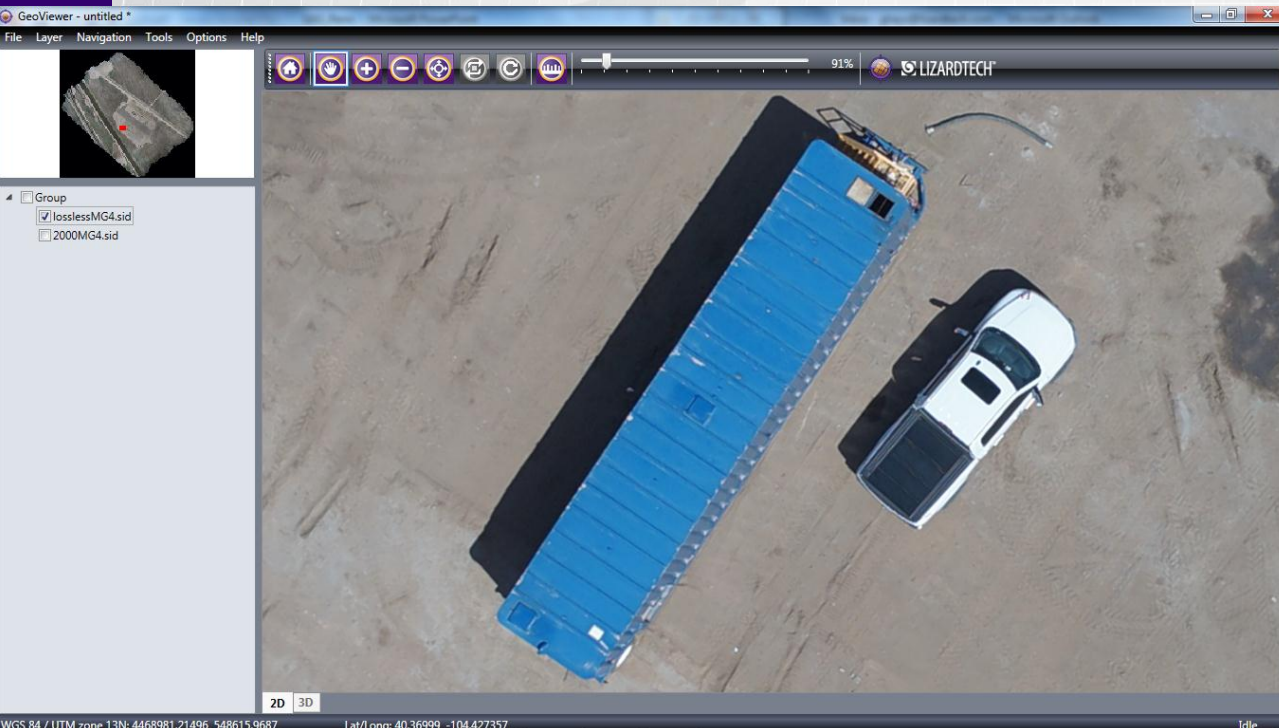
Lossy 500:1
4.6 MB

- 900MG4.sid
- 900MG3.sid
- 800MG4.sid
- 800MG3.sid
- 700MG4.sid
- 600MG4.sid
- 500MG4.sid
- 400MG4.sid
- 300MG4.sid
- 200MG4.sid
- 100MG4.sid
- 90MG4.sid
- 80MG4.sid
- 70MG4.sid
- 60MG4.sid
- 50MG4.sid
- 40MG4.sid
- 30MG4.sid
- 20MG4.sid
- 10MG4.sid
- losslessMG4.sid
- 2000MG4.sid



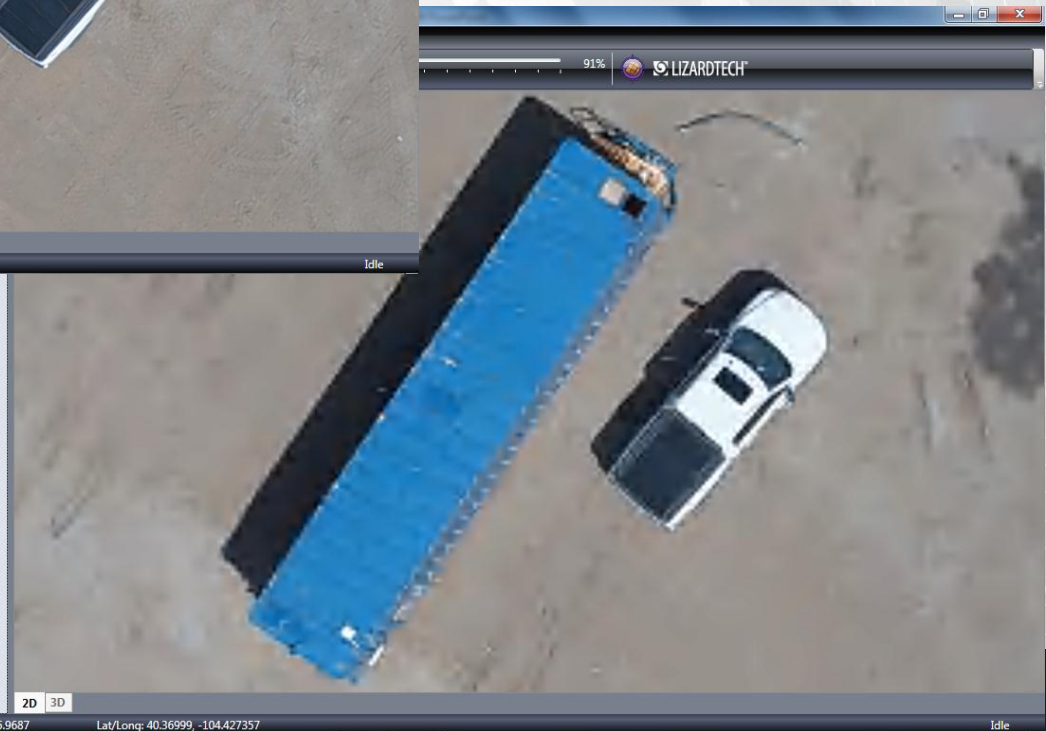
Compression ratios

3.04 GB TIFF



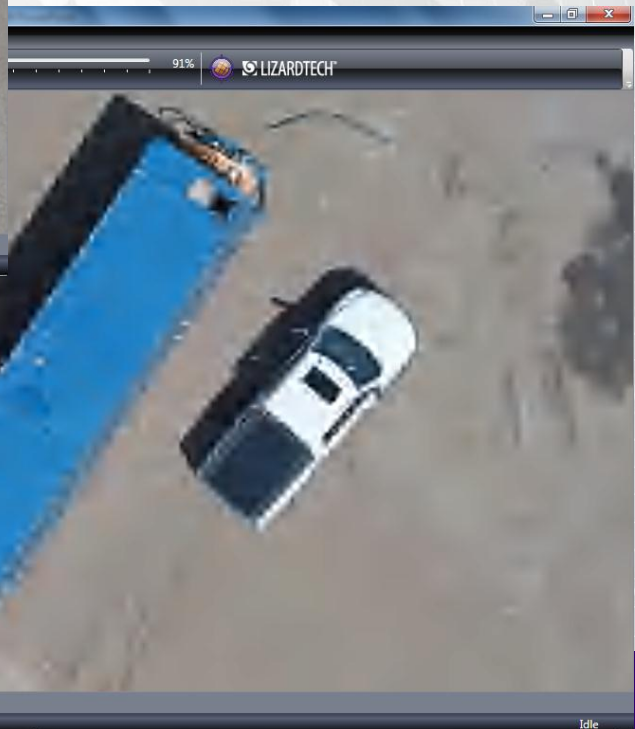
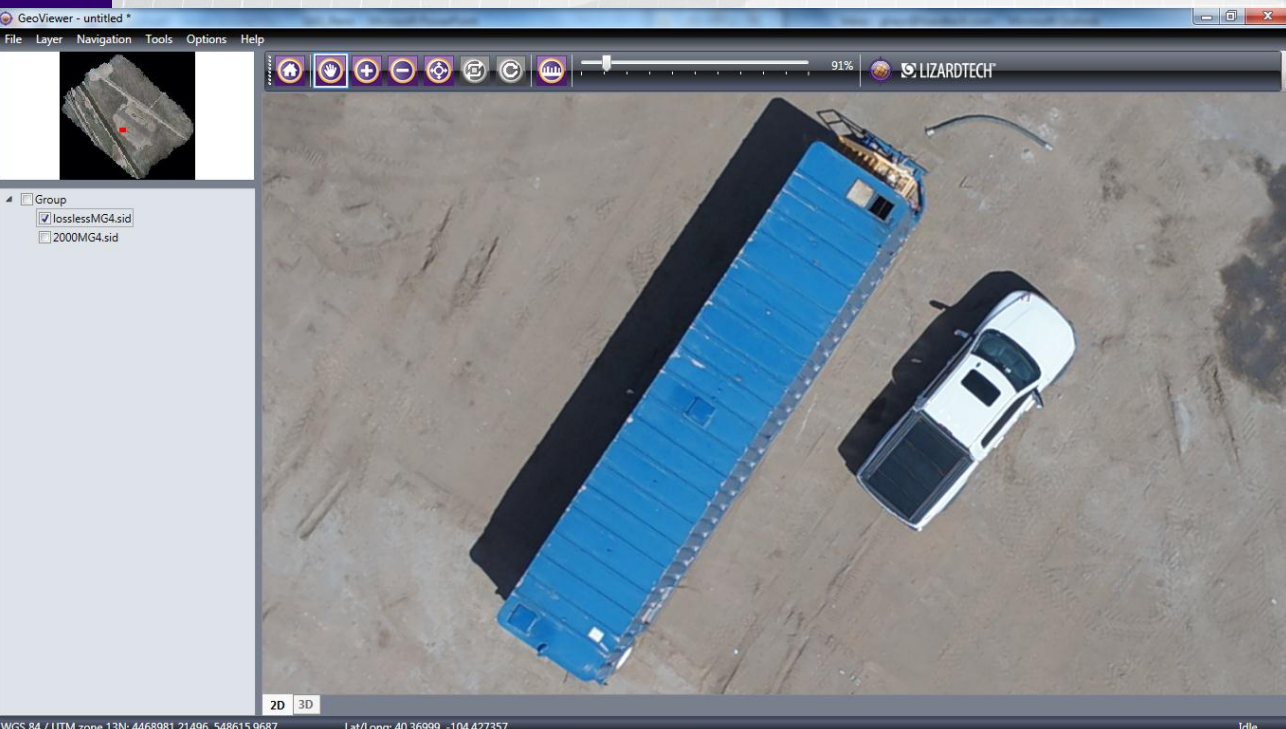
Lossy 1000:1
2.3 MB

- 900MG4.sid
- 900MG3.sid
- 800MG4.sid
- 800MG3.sid
- 700MG4.sid
- 600MG4.sid
- 500MG4.sid
- 400MG4.sid
- 300MG4.sid
- 200MG4.sid
- 100MG4.sid
- 90MG4.sid
- 80MG4.sid
- 70MG4.sid
- 60MG4.sid
- 50MG4.sid
- 40MG4.sid
- 30MG4.sid
- 20MG4.sid
- 10MG4.sid
- losslessMG4.sid
- 2000MG4.sid



Compression ratios

3.04 GB TIFF



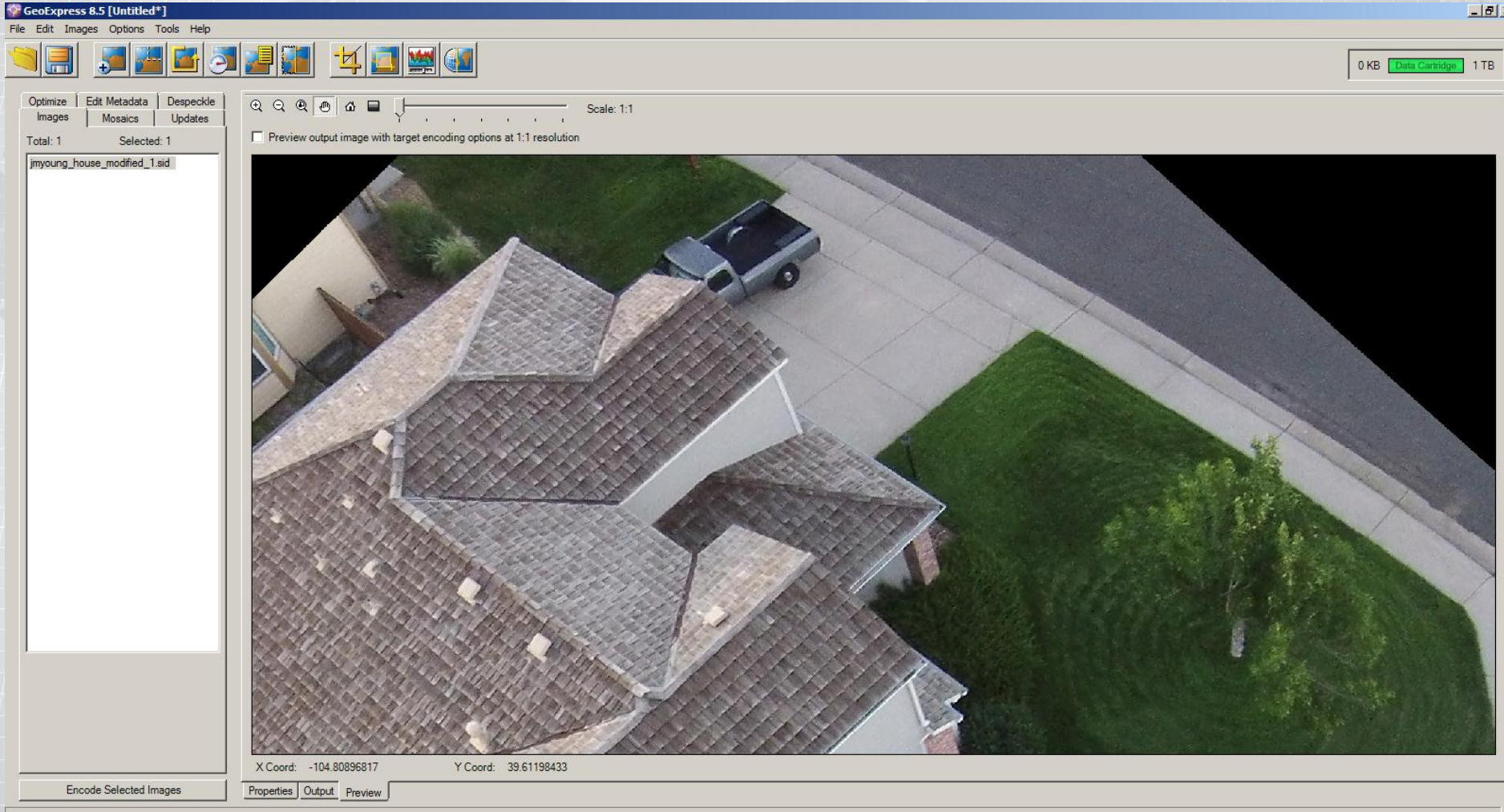
Lossy 2000:1
1.1 MB

- 900MG3.sid
- 800MG4.sid
- 800MG3.sid
- 700MG4.sid
- 600MG4.sid
- 500MG4.sid
- 400MG4.sid
- 300MG4.sid
- 200MG4.sid
- 100MG4.sid
- 90MG4.sid
- 80MG4.sid
- 70MG4.sid
- 60MG4.sid
- 50MG4.sid
- 40MG4.sid
- 30MG4.sid
- 20MG4.sid
- 10MG4.sid
- losslessMG4.sid
- 2000MG4.sid

WGS 84 / UTM zone 13N: 4468977.86013, 548615.9687 Lat/Long: 40.36996, -104.427357

Idle

The Sand Box





Thank you

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