"Keep Alaska Moving"

Alaska Department of
Transportation & Public Facilities

Small Unmanned Aerial Systems (SUAS)

Use in Surveying and Mapping

September 11, 2017

Who am I?

Troy Hicks, PLS

- Surveyor DOT Northern Region
- Land Surveying since 2004
- B.S. Geomatics & Land Surveying
- B.S. General Studies (physics & math)

2016 recap – how we ended up using SUAS

- Designed Low Distortion Projections (LDP)
    - Significant contribution to the state (2015)
    - Being used in 2016
    - GIS compatible
- Adding **Remote Sensing** data as part of our workflow

- Products:
    - Ortho-mosaic (2D geospatially and ortho rectified aerial image)
    - Point Clouds (3D clouds of points – usually 10 million to billions)

LDP Map – from draft website

New stuff = new issues

- **Test and deploy new coordinate systems**

- **New Software:**
  Global Mapper,
  Quick Terrain Modeler
  Photoscan

- **New computer:**
  12 core, 128 gig ram, video card

So what?

- Learned how to order, collect, use, and integrate in Remote Sensing data. Thank you GIS and Remote Sensing professionals.

- 2016 - Manned and unmanned remote sensing by consultants
- 2017 - time to collect some ourselves (SUAS only!)
- To gain familiarity of SUAS, I built my own from scratch.
- Got 4 employees to gain FAA Part 107 drone pilot licenses
- We procured 3 SUAS

Many ways to get data – and each has challenges

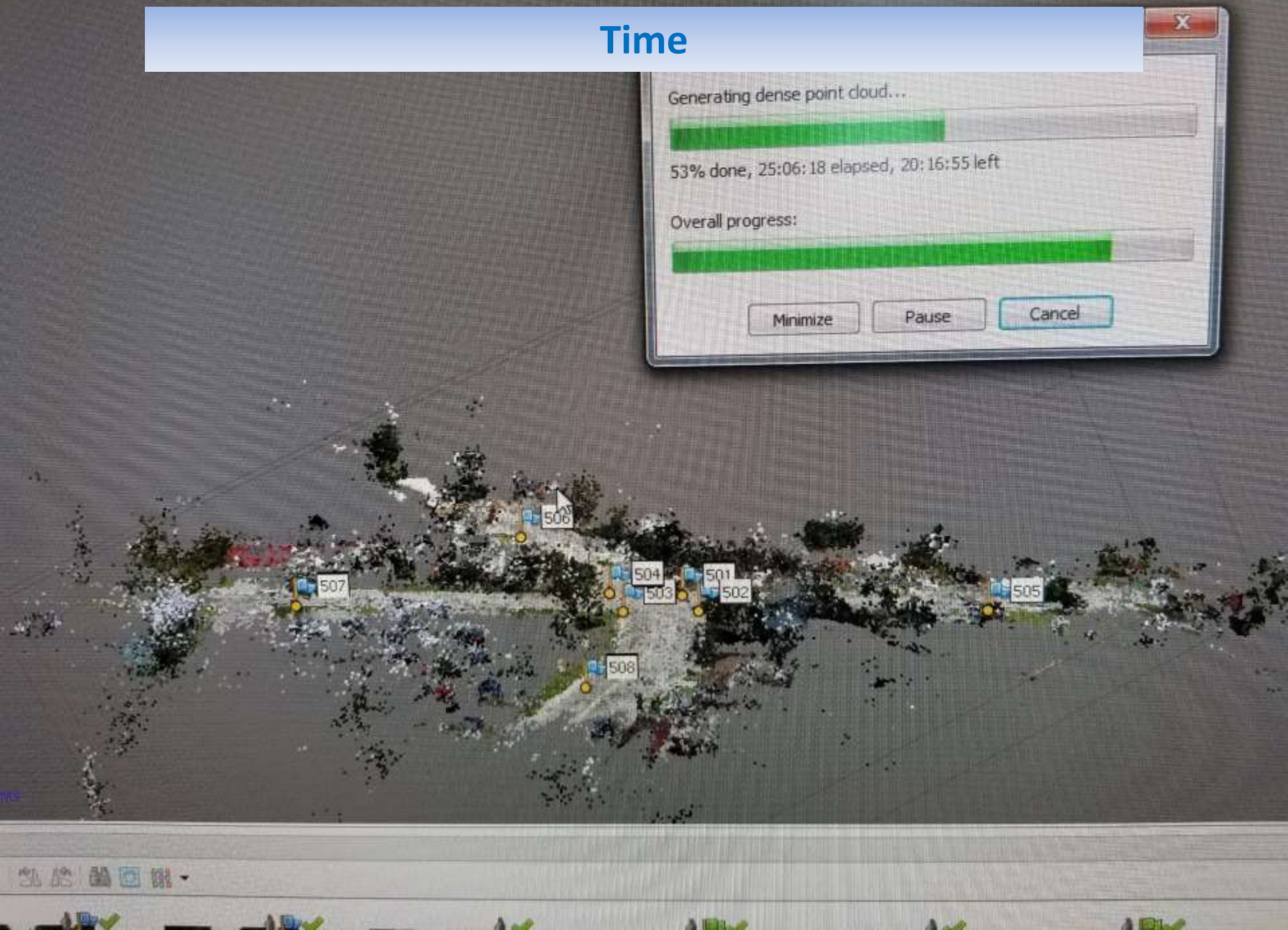
Fairbanks Area
A few combined ortho-mosaics
150 gigs
Manned Aircraft at 1500ft
Tens of miles of data

Richardson 351
1405 photos
47gigs
SUAS at 400ft
105 acres

Lathrop / 10th
912 photos
4.5 gigs
Person holding smart phone at 6ft
0.5 acre

All this data!!

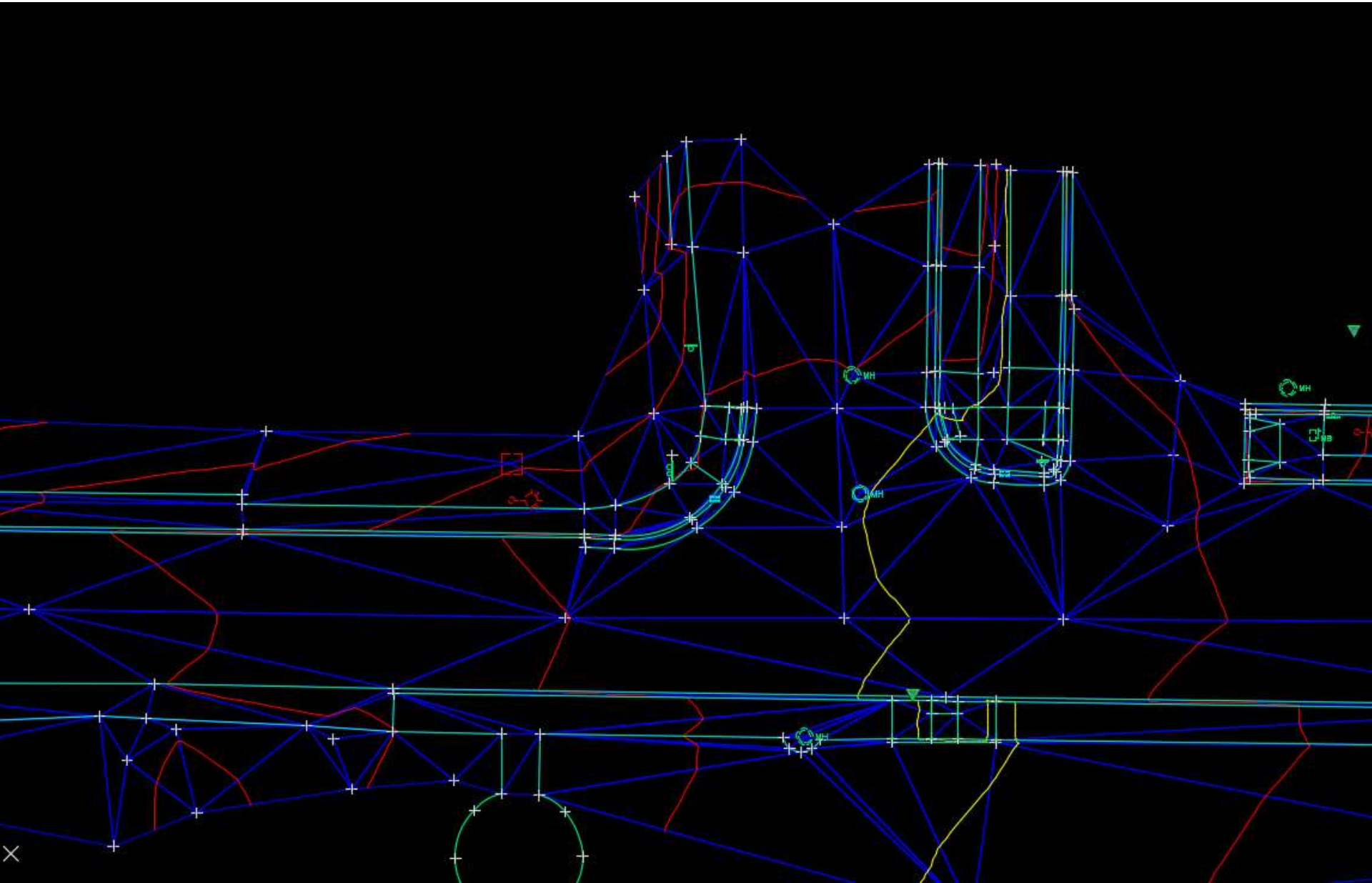
Time


Generating dense point cloud...
53% done, 25:06:18 elapsed, 20:16:55 left
Overall progress:
Minimize
Pause
Cancel
506
507
504
503
501
502
505
508

Phantom 4 Pro - DJI

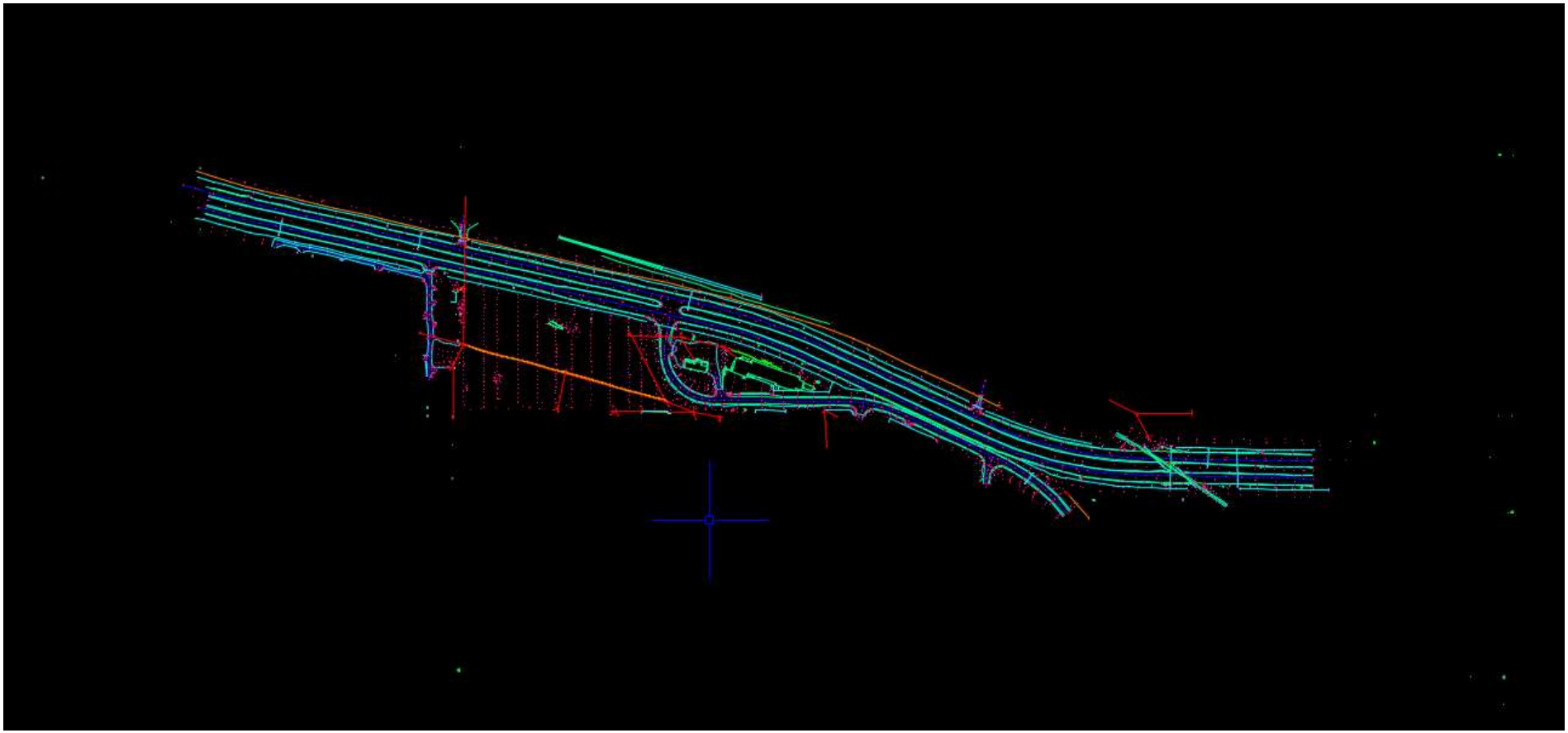
Custom

Finished survey in civil3d – Yukon Drive (UAF)

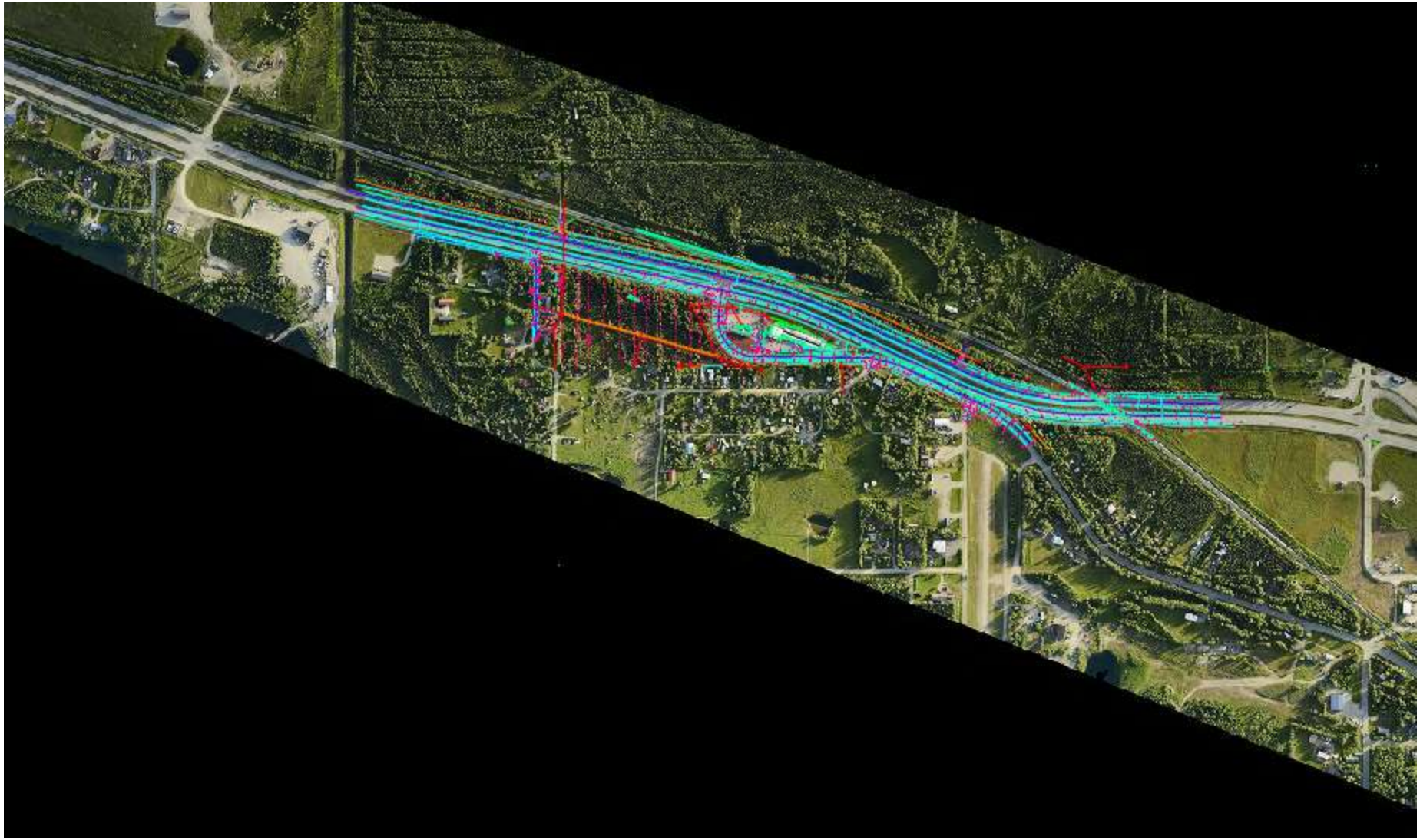


Added ortho-mosaic from Drone

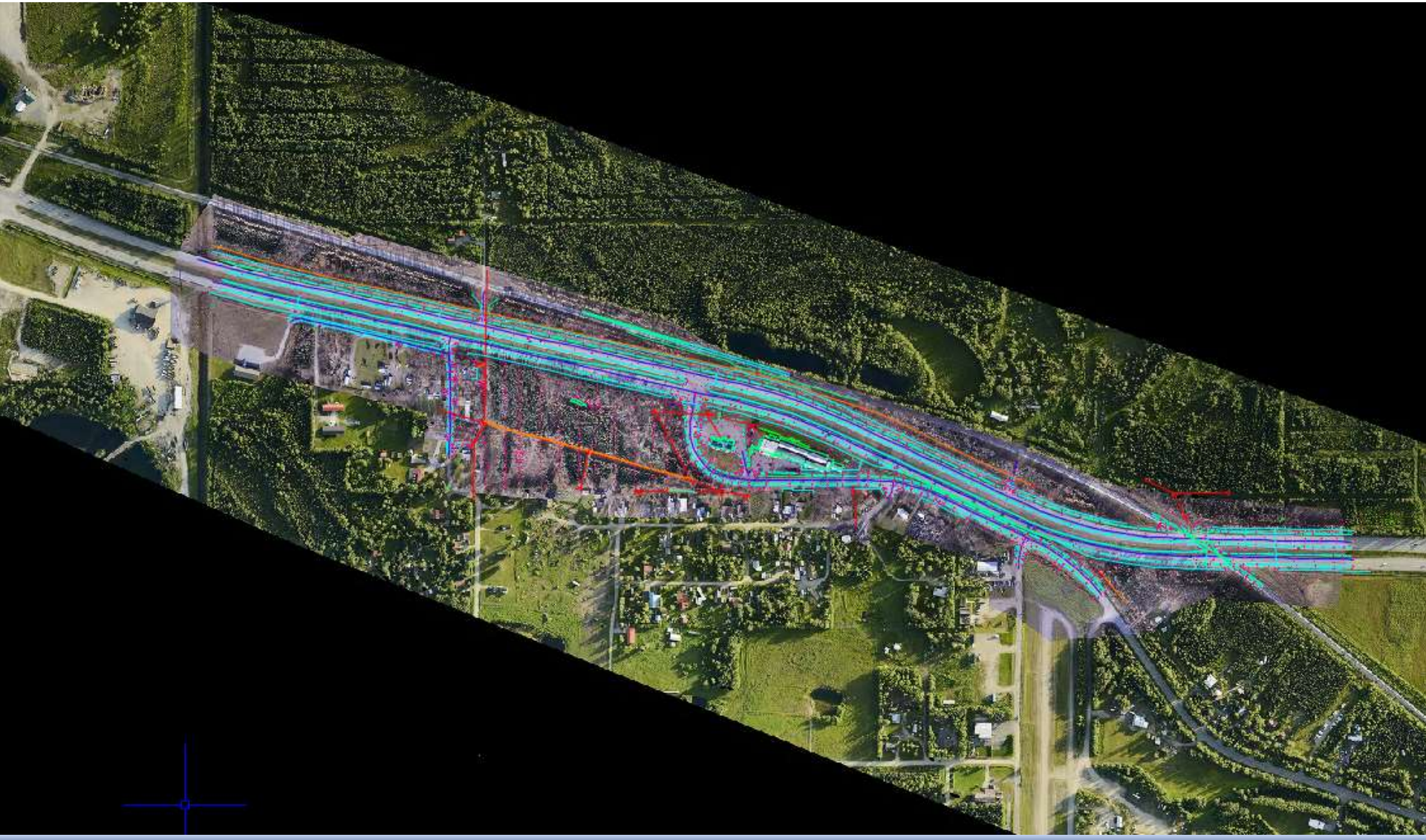
Finished survey in civil3d – Rich 351



Added in ortho-mosaic – manned aircraft



mixed in ortho-mosaic from SUAS



Close up – both very accurate

More detail – but larger file size

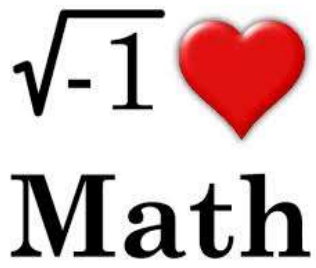
Point Clouds


All returns

Bare earth - ground

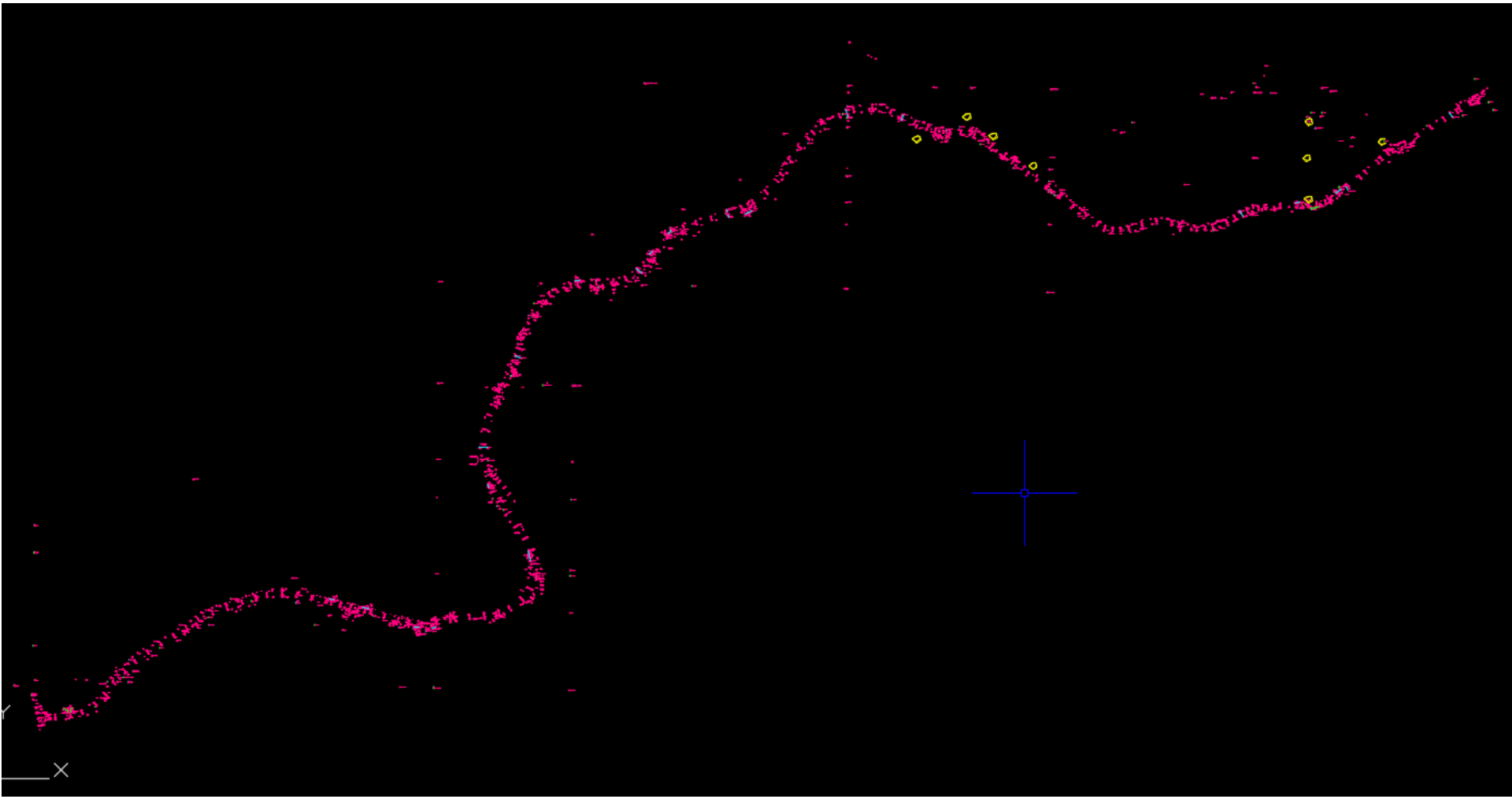
Trust but verify … check data!

2.83	490.02	837 Lidar value		-0.092	0.00850083999999837
7140	506.31	838 Lidar value		-0.150	0.02247001000000070
75.6	522.1	839 Lidar value		-0.045	0.00199808999999291
5.83	546.69	840 Lidar value		-0.104	0.01083680999997980
9.89	546.51	841 Lidar value		0.000	0.00000016000000001
3.56	548.56	842 Lidar value		-0.184	0.03389281000002120
3.72	596.67	844 Lidar value		0.017	0.00029928999999922
			average	-0.007	
			sdev	0.106	
			RMSE	0.105	
			n=	43	

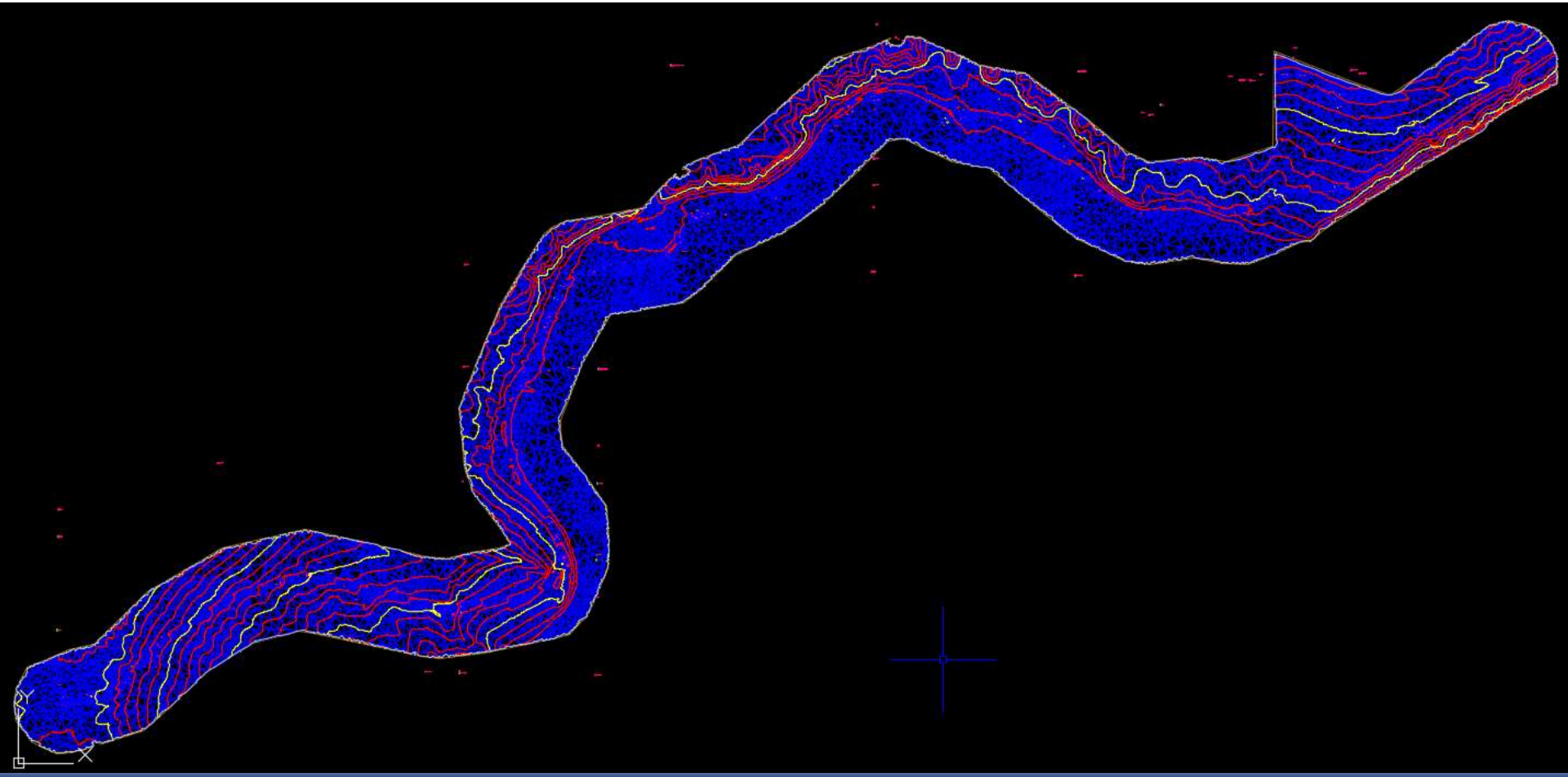


move would only be 0.007, therefore not needed.

Rosie Creek Rd – ground survey

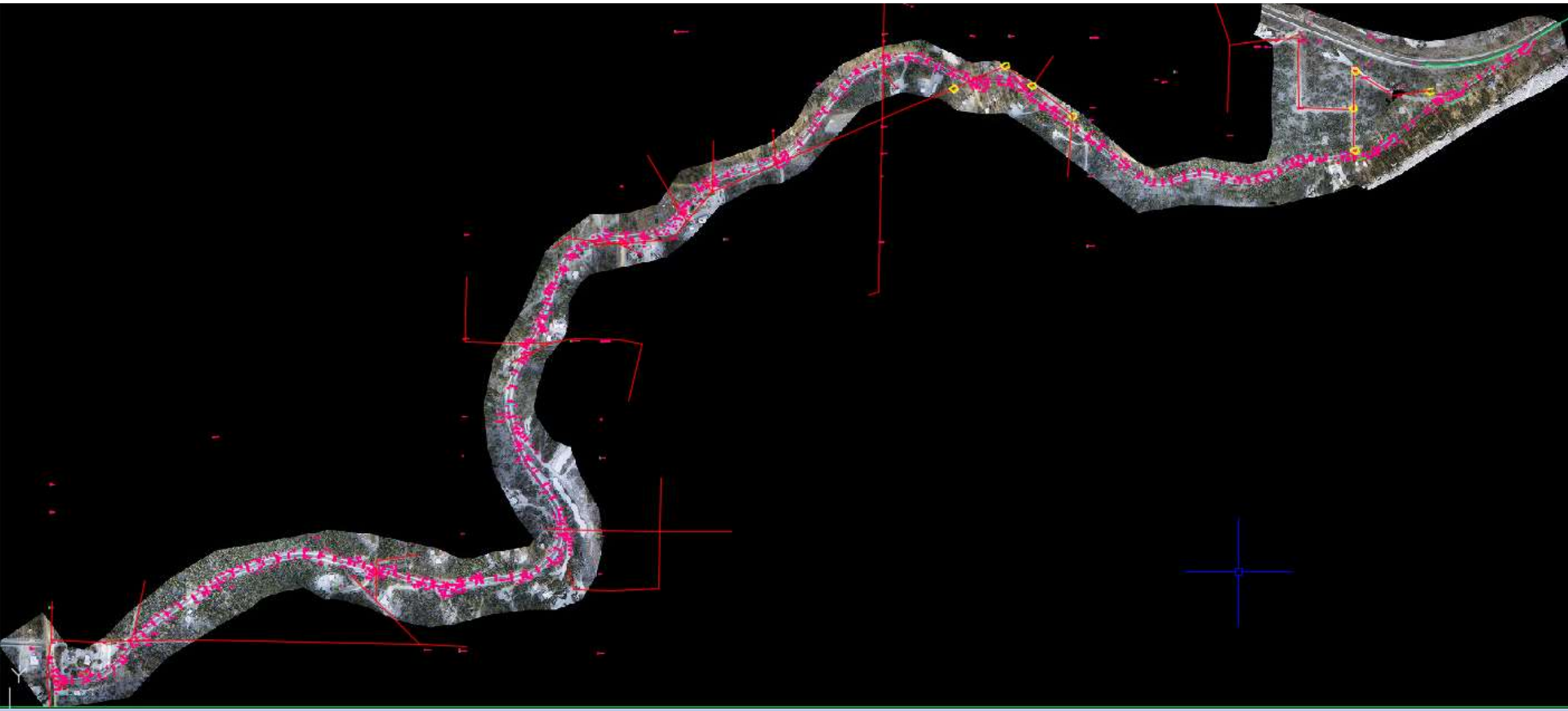


Rosie Creek Rd – Lidar point cloud added



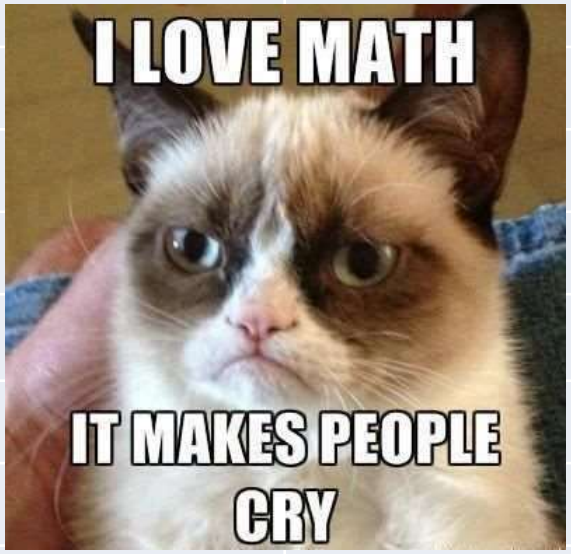
Rosie Creek Rd – Ortho-mosaic

Rosie Creek Rd – Ortho-mosaic - Drone



Trust but verify … check data!

pixel size		**measured**		
0.08	m		feet	meters
0.25	ft	RMSEr	0.14	0.04
		RMSE95	0.24	0.07
			expected	
			feet	meter
		RMSEr	0.35	0.11
		RMSE95	0.61	0.19
		n=13		



GIS = Get It Surveyed

GIS

What my friends think I do

What my mom thinks I do

What society thinks I do

What my clients think I do

What I think I do

What I really do

Still long way to go

Projects using SUAS

- Rosie Creek Rd
- Rich 351
- Yukon Dr (UAF)
- College/Aurora
- North Pole Light Poles
- Valdez Glacier Stream
- To Cutoff 38-50
- Rich 112.5
- Rich 18-24, 65-115
- Nome Council Rd

How has it saved money?

Catching errors, extra data so less return to field, collecting data ourselves using inexpensive equipment, safety.

Badger Rd example

The future