NWBReport_20210909

Processing Report
16 September 2021

Survey Data

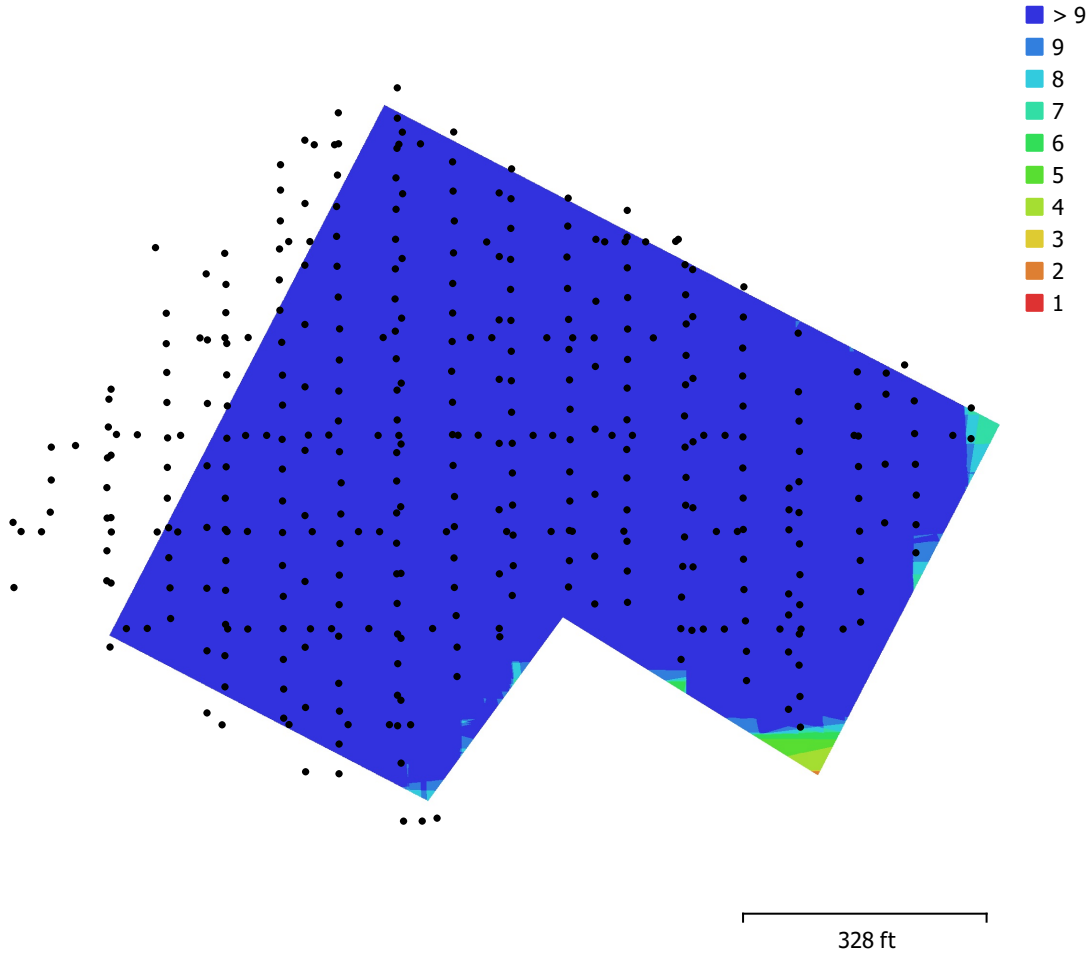

Fig. 1. Camera locations and image overlap.

Number of images:	373	Camera stations:	372
Flying altitude:	230 ft	Tie points:	307,767
Ground resolution:	0.0565 ft/pix	Projections:	1,352,107
Coverage area:	6.98e+04 yd²	Reprojection error:	1.23 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6510 (8.8mm)	5472 x 3648	8.8 mm	2.41 x 2.41 µm	Yes
FC6310 (8.8mm)	5472 x 3648	8.8 mm	2.41 x 2.41 µm	No

Table 1. Cameras.

Camera Calibration

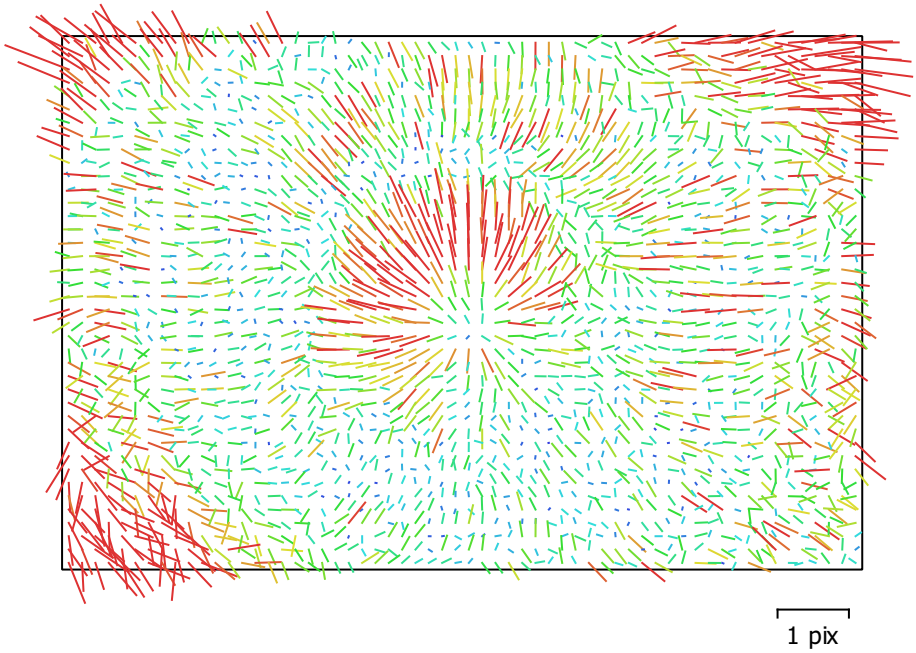

Fig. 2. Image residuals for FC6510 (8.8mm).

FC6510 (8.8mm)

220 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	**5472 x 3648**	**8.8 mm**	**2.41 x 2.41 µm**

F:	3699.37		
Cx:	16.2646	B1:	0
Cy:	-2.97572	B2:	0
K1:	0.0025491	P1:	0.00195216
K2:	0.00621435	P2:	0.000499669
K3:	-0.00196486	P3:	0
K4:	0	P4:	0

Camera Calibration

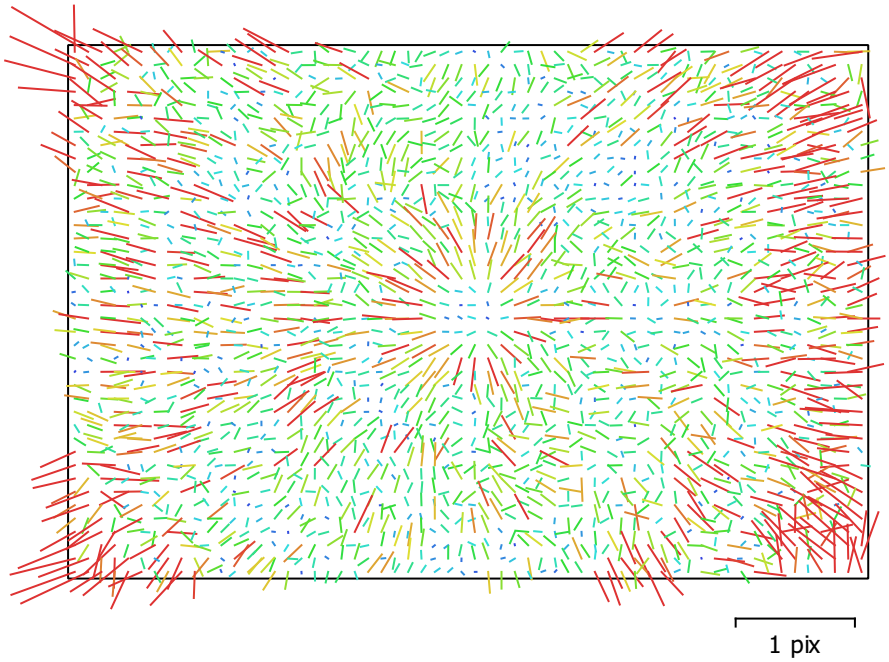

Fig. 3. Image residuals for FC6310 (8.8mm).

FC6310 (8.8mm)

153 images

Type	Resolution	Focal Length	Pixel Size
Frame	**5472 x 3648**	**8.8 mm**	**2.41 x 2.41 µm**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	P1	P2
F	**3650.61**	0.061	1.00	0.01	-0.63	0.26	-0.07	-0.22	0.20	-0.18	0.04	-0.02
Cx	**17.7542**	0.04		1.00	-0.00	0.07	0.51	0.01	-0.02	0.02	0.77	0.01
Cy	**10.7926**	0.048			1.00	-0.63	0.09	0.00	0.00	-0.00	-0.03	0.40
B1	**0.555474**	0.011				1.00	-0.02	-0.00	-0.03	0.04	0.07	0.05
B2	**-0.0547166**	0.01					1.00	0.02	-0.02	0.01	0.04	0.05
K1	**-0.00226445**	4.2e-05						1.00	-0.97	0.91	0.01	-0.00
K2	**-0.00563478**	0.00012							1.00	-0.98	-0.02	-0.01
K3	**0.00602664**	0.00011								1.00	0.02	0.01
P1	**0.00276534**	3.2e-06									1.00	-0.00
P2	**-0.000360713**	2.5e-06										1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

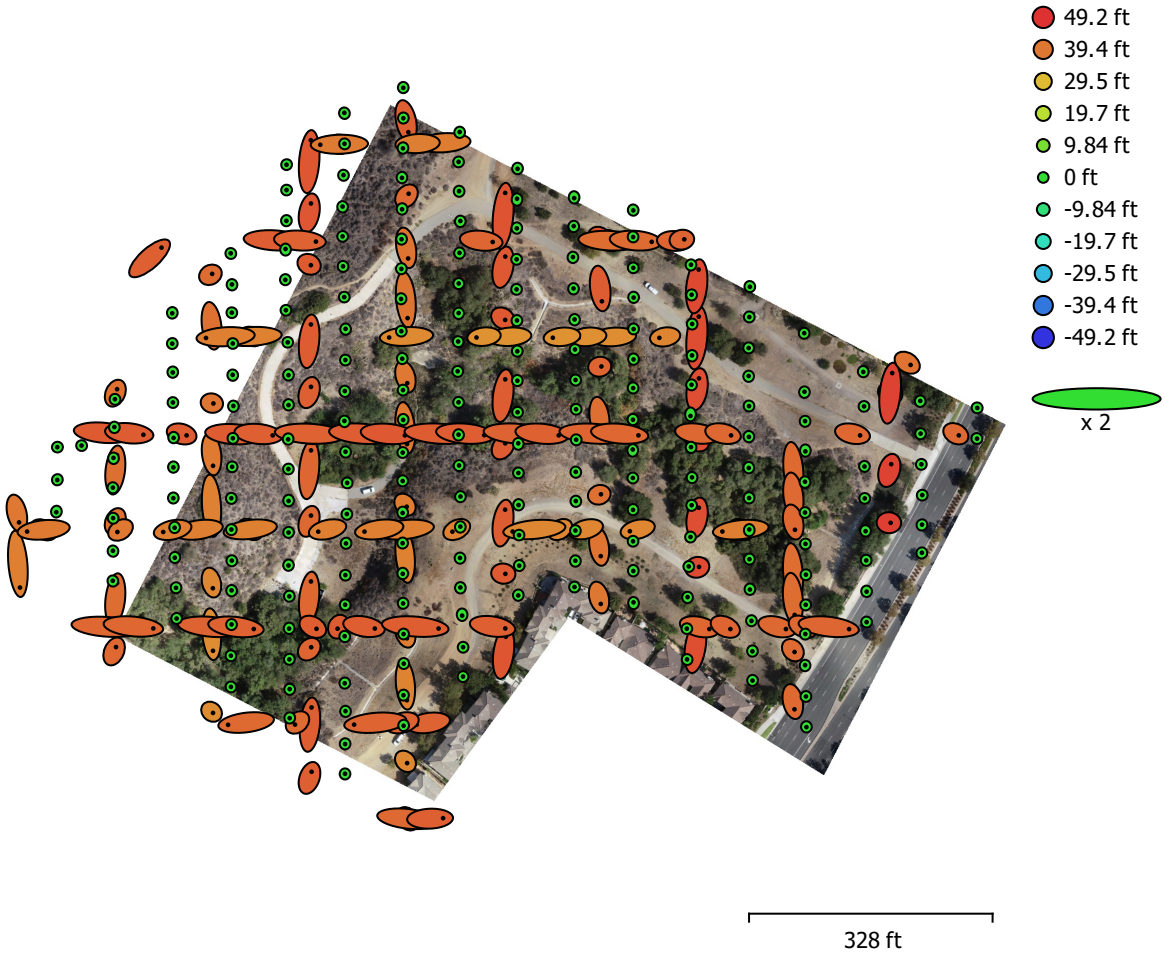

Fig. 4. Camera locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

X error (ft)	Y error (ft)	Z error (ft)	XY error (ft)	Total error (ft)
9.25679	7.26222	26.3056	11.7655	28.8169

Table 3. Average camera location error.
X - Longitude, Y - Latitude, Z - Altitude.

Ground Control Points

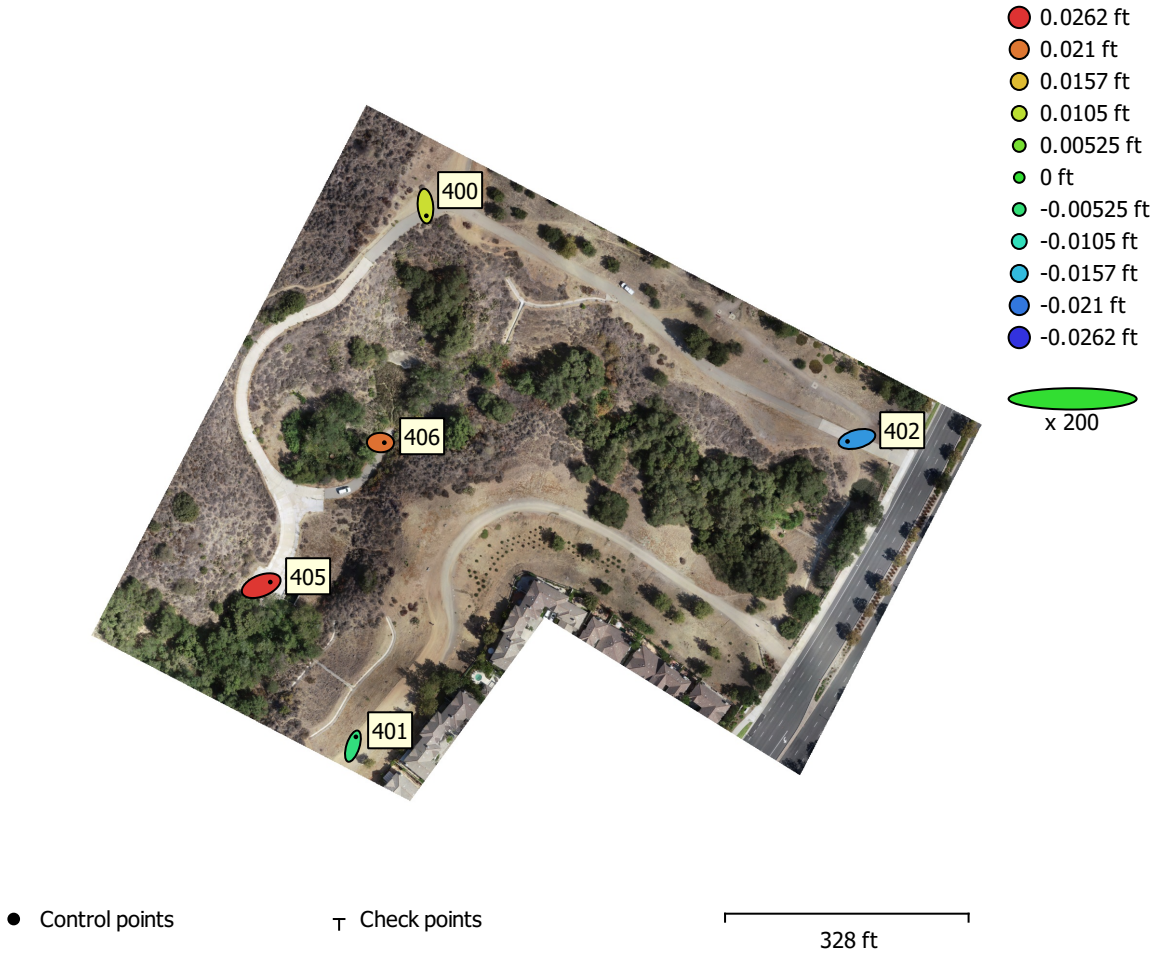

Fig. 5. GCP locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated GCP locations are marked with a dot or crossing.

Count	X error (ft)	Y error (ft)	Z error (ft)	XY error (ft)	Total (ft)
5	0.0843296	0.0848857	0.0181539	0.119654	0.121023

Table 4. Control points RMSE.
X - Longitude, Y - Latitude, Z - Altitude.

Label	X error (ft)	Y error (ft)	Z error (ft)	Total (ft)	Image (pix)
400	0.0120304	-0.130088	0.0116976	0.131166	0.897 (8)
401	0.039915	0.125235	-0.00573452	0.131567	1.026 (8)
402	-0.126461	-0.0327032	-0.0186376	0.131944	1.003 (8)
405	0.123021	0.0484709	0.0258974	0.134738	1.033 (8)
406	0.0518934	-0.00148744	0.0214491	0.0561712	0.732 (8)
Total	**0.0843296**	**0.0848857**	**0.0181539**	**0.121023**	**0.945**

Table 5. Control points.
X - Longitude, Y - Latitude, Z - Altitude.

Digital Elevation Model

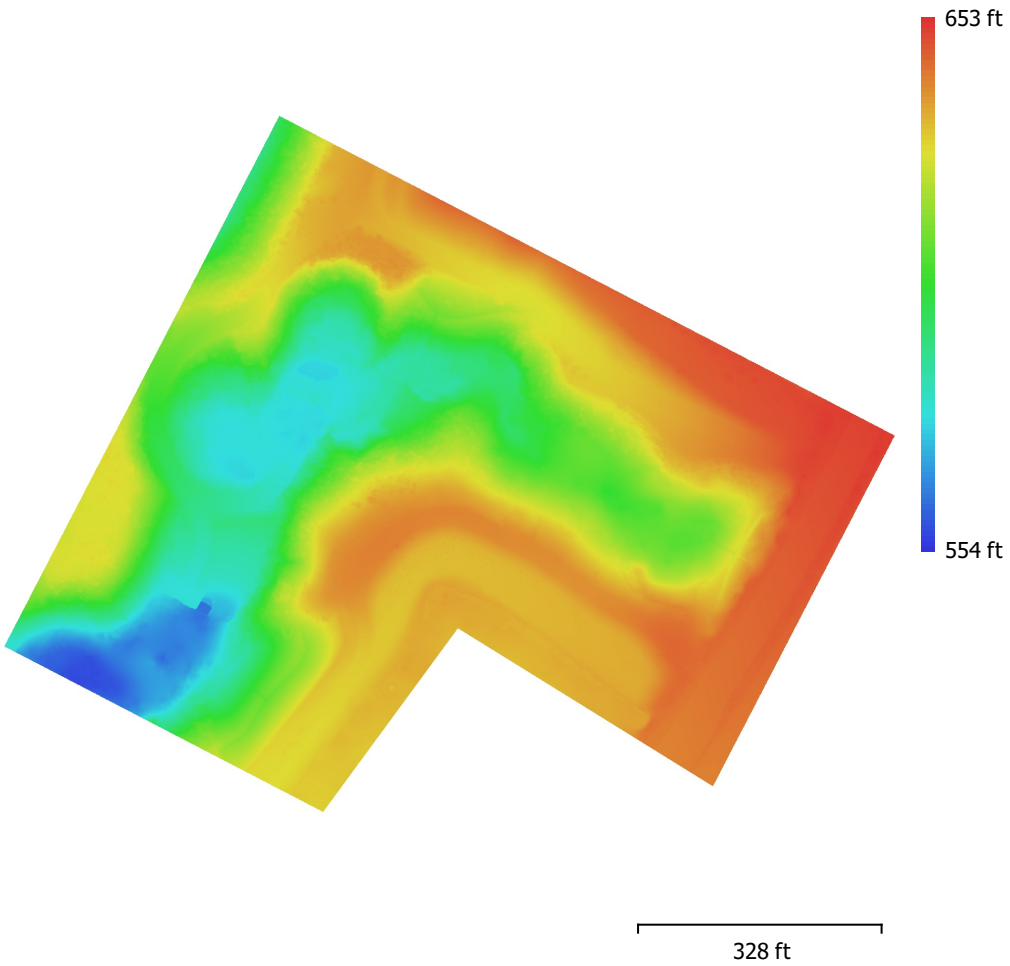

Fig. 6. Reconstructed digital elevation model.

Resolution:	0.113 ft/pix
Point density:	78.3 points/ft²

Processing Parameters

General	
Cameras	373
Aligned cameras	372
Markers	5
Shapes	
Polygon	1
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll
Point Cloud	
Points	307,767 of 337,952
RMS reprojection error	0.206985 (1.22952 pix)
Max reprojection error	0.625148 (50.2377 pix)
Mean key point size	4.59148 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	4.86855
Alignment parameters	
Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Tie point limit	4,000
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	Yes
Matching time	5 minutes 10 seconds
Matching memory usage	319.85 MB
Alignment time	1 minutes 26 seconds
Alignment memory usage	173.48 MB
Software version	1.7.2.12070
File size	33.17 MB
Depth Maps	
Count	358
Depth maps generation parameters	
Quality	High
Filtering mode	Mild
Processing time	34 minutes 13 seconds
Memory usage	6.53 GB
Software version	1.7.2.12070
File size	2.46 GB
Dense Point Cloud	
Points	81,856,659
Point colors	3 bands, uint8
Depth maps generation parameters	
Quality	High
Filtering mode	Mild
Processing time	34 minutes 13 seconds
Memory usage	6.53 GB
Dense cloud generation parameters	
Processing time	31 minutes 29 seconds

Memory usage	17.32 GB
Ground points classification parameters	
Max angle (°)	2.5
Max distance (m)	0.0762002
Cell size (m)	15.24
Classification time	18 minutes 25 seconds
Classification memory usage	3.49 GB
Software version	1.7.2.12070
File size	1.20 GB
Model	
Faces	16,369,946
Vertices	8,188,217
Vertex colors	3 bands, uint8
Depth maps generation parameters	
Quality	High
Filtering mode	Mild
Processing time	34 minutes 13 seconds
Memory usage	6.53 GB
Reconstruction parameters	
Surface type	Height field
Source data	Dense cloud
Interpolation	Enabled
Strict volumetric masks	No
Processing time	7 minutes 54 seconds
Memory usage	2.06 GB
Software version	1.7.2.12070
File size	374.73 MB
DEM	
Size	10,655 x 10,185
Coordinate system	NAD83 / California zone 6 (ftUS) (EPSG::2230)
Reconstruction parameters	
Source data	Dense cloud
Interpolation	Enabled
Processing time	1 minutes 13 seconds
Memory usage	359.08 MB
Software version	1.7.2.12070
File size	202.51 MB
Orthomosaic	
Size	21,244 x 17,997
Coordinate system	WGS 84 (EPSG::4326)
Colors	3 bands, uint8
Reconstruction parameters	
Blending mode	Mosaic
Surface	Mesh
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	1 hours 54 minutes
Memory usage	5.27 GB
Software version	1.7.2.12070
File size	5.98 GB
System	
Software name	Agisoft Metashape Professional
Software version	1.7.2 build 12070
OS	Windows 64 bit
RAM	127.88 GB
CPU	AMD Ryzen Threadripper 2990WX 32-Core Processor

GPU(s)	Quadro RTX 5000