North Carolina Department of Public Safety

Emergency Management

Pat McCrory, Governor
Frank L. Perry, Secretary

Michael A. Sprayberry, Director

Aerial Imagery Quality Control Report – Southern Piedmont and Mountains 2015 Project

The North Carolina Geodetic Survey (NCGS) performed a horizontal quality control (QC) survey of aerial imagery collected in twenty-four North Carolina counties. The purpose of the QC survey was to test the horizontal accuracy of the aerial imagery collected as part of the 2015 Southern Piedmont and Mountains Orthoimagery Project which is funded by the NC 911 Board.

NCGS contracted private surveying firms to collect the horizontal QC test points and submit a report, which are on file at NCGS.

This is a supplemental report that contains the revised results for Scotland and Richmond counties. A revised report was required because re-flights occurred in 2016 in Scotland and Richmond counties.

In addition to the contractor collected QC test points, NCGS personnel, who were under the supervision of James G. Gay (L-3851), collected supplemental QC test points using the following GNSS survey parameters:

Class of survey:	Class A (horizontal) Class C (vertical)
Horizontal accuracy:	0.01 meters (0.03 USft) at the 95% confidence level
Vertical accuracy:	0.01 meters (0.03 USft) at the 95% confidence level
Type of field procedure used:	North Carolina Real Time Network (NCRTN)
Dates of survey:	January 4, 2016 – January 5, 2016
Horizontal datum/epoch	North American Datum 83(2011) epoch 2010.0
Vertical datum/epoch	North American Vertical Datum of 1988 (NAVD88)
Published fixed control used:	North Carolina Continuously Operating Reference Station (CORS) Network and North Carolina Real-Time Network (NCRTN)
Geoid model:	Geoid12A
Combined grid factor:	See attached control spreadsheet
Units:	US Survey Feet

The attached report contains the results of the horizontal QC surveys (Scotland and Richmond counties only) conducted by the contractors and the supplemental QC surveys conducted by NCGS personnel. The review of the field data and the generation of the final QC report were performed under the supervision of Gary W. Thompson (L-2694).

NORTH CAROLINA PROFESSIONAL SEAL 3851 LAND SURVEYOR JAMES G GAY

James G. Gay L-3851 6/22/16
date

NORTH CAROLINA PROFESSIONAL SEAL L-2694 LAND SURVEYOR GARY WILLIAM THOMPSON

Gary W. Thompson L-2694 6/22/16
date

MAILING ADDRESS
4218 Mail Service Center
Raleigh NC 27699-4218
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OFFICE LOCATION
4105 Reedy Creek Rd.
Raleigh, NC 27607
Telephone: (919) 715-5711
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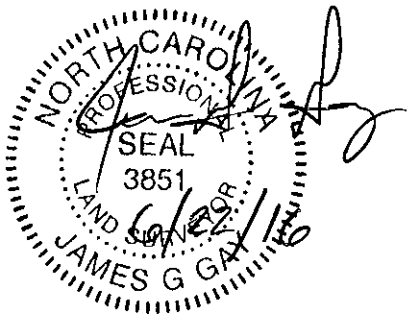
This supplemental report contains the revised horizontal QC reports for the following counties:

- Scotland
- Richmond



2015 Orthoimagery Statistics Summary - Reflight Areas

NAD 83/2011 US Survey Feet

County	MinΔX:	MinΔY:	MaxΔX:	MaxΔY:	MeanΔX	MeanΔY	RmseX:	RmseY:	RmseH:	CE90:	CE95:	CI:	No.Obs.:	NSSDA:
Richmond	-1.302	-0.564	0.868	1.085	-0.104	0.215	**0.450**	**0.414**	0.612	0.863	0.984	0.137	33	1.059
Scotland	-0.608	-0.738	0.868	0.825	0.109	-0.047	**0.337**	**0.324**	0.467	0.696	0.793	0.107	35	0.809
					County-Wide Average		**0.394**	**0.369**	0.540	0.780	0.889	0.122		0.934

NORTH CAROLINA GEODETIC SURVEY
Claude T Bowers Building
4105 Reedy Creek Road
Raleigh, North Carolina 27607
(919)733-3836

CompassAA™

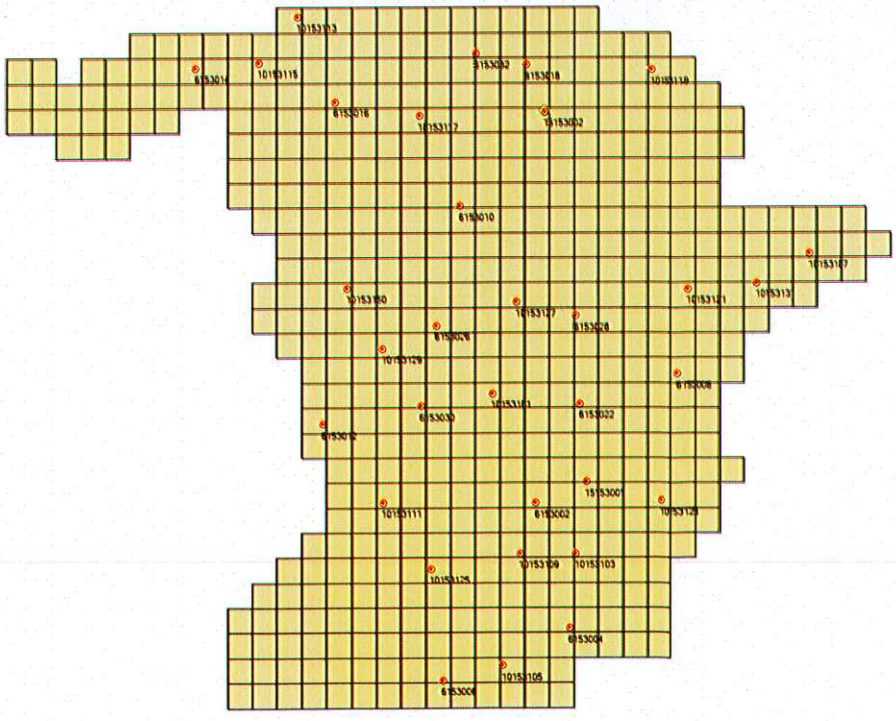
Project Information

Prepared By: Watson Ross
Project Name: 2015 Aerial Photo QC
Sensor Info: N/A
Sensor Resolution: 0.5
Vendor Name: Quantum Spatial, Inc.
Date of Aquisition: Start: 3/8/2015 Finish: 4/1/2015

Metadata Information

Index File Name: richmond_tiles.shp
# of Polygons: 551
# of Matching Images: 551
Polygon ID: filename
Units: Feet
Image Folder Path: D:\RICHMOND2015\Imagery\TIFF
Threshold: Other: 1.5
Scaling Used: 1:100

Tiled-Image Area



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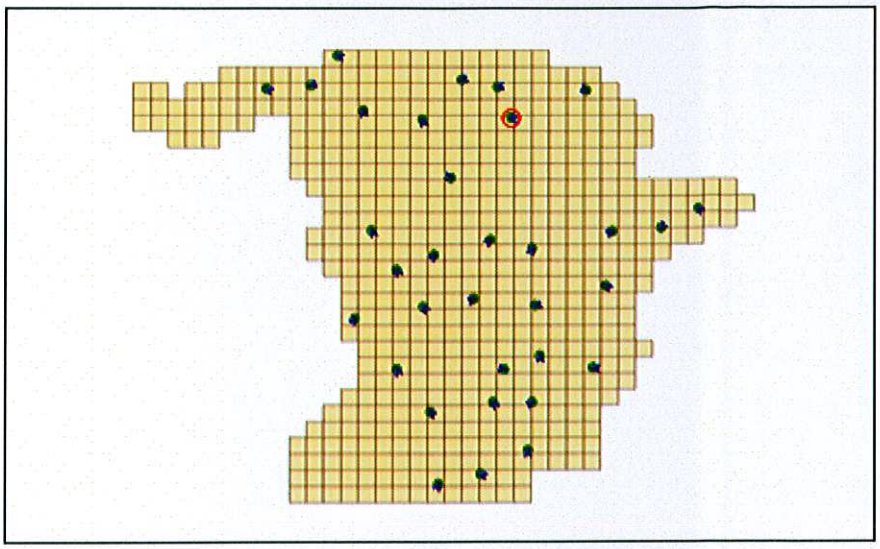
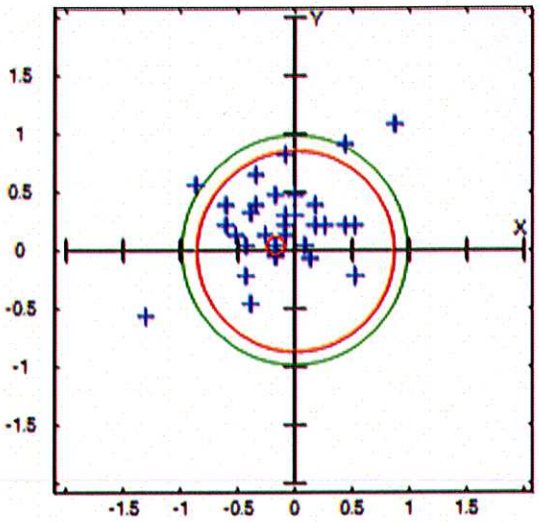
Vector Offset



Scaling Factor: 200

Circular Error



Error Statistics

Min ΔX:	-1.302
Min ΔY:	-0.564
Max ΔX:	0.868
Max ΔY:	1.085
Mean ΔX:	-0.104
Mean ΔY:	0.215
RmseX:	0.45
RmseY:	0.414
RmseH:	0.612
NSSDA:	1.059
No. Obs.:	33
CE 90:	0.863
CE 95:	0.984
CI:	0.137

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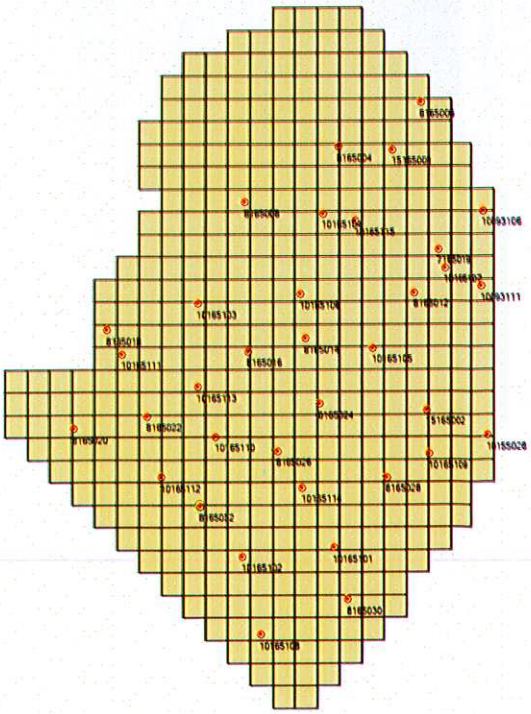
Project Information

Prepared By: Watson Ross
Project Name: 2015 Aerial Photo QC
Sensor Info: N/A
Sensor Resolution: 0.5
Vendor Name: Quantum Spatial, Inc.
Date of Aquisition: Start: 3/29/2015 Finish: 4/1/2015

Metadata Information

Index File Name: scotland_tiles.shp
# of Polygons: 437
# of Matching Images: 437
Polygon ID: filename
Units: Feet
Image Folder Path: D:\SCOTLAND2015\Imagery\TIFF
Threshold: Other: 1.5
Scaling Used: 1:100

Tiled-Image Area



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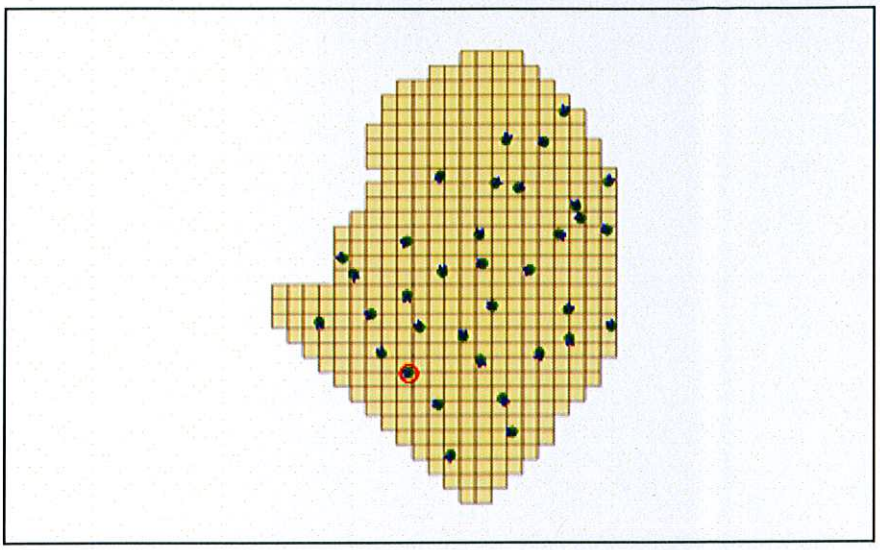
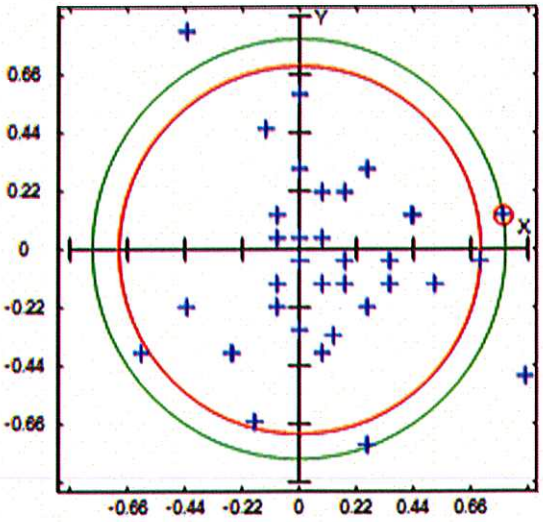
Vector Offset



Scaling Factor: 200

Circular Error



Error Statistics

Min ΔX:	-0.608
Min ΔY:	-0.738
Max ΔX:	0.868
Max ΔY:	0.825
Mean ΔX:	0.109
Mean ΔY:	-0.047
RmseX:	0.337
RmseY:	0.324
RmseH:	0.467
NSSDA:	0.809
No. Obs.:	35
CE 90:	0.696
CE 95:	0.793
CI:	0.107

Station Name	PID	Ellipsoid Height (m)	NAVD88 Orthometric Height (m)	NAD83(2011) Epoch 2010.0 Latitude DMS	Longitude DMS	SPC North (m)	SPC East (m)	SPC Combined Factor
MURPHY CORS ARP	DL1890	504.810	476.123	35 04 06.77760 N	083 57 59.36142 W	157594.804	156842.278	0.99980296
ROBBINSVILLE CORS ARP	DM3993	635.150	606.659	35 19 15.69235 N	083 47 48.68948 W	184808.885	173646.886	0.99977812
BRYSON CITY CORS ARP	DL2762	594.790	566.148	35 22 21.56251 N	083 30 23.37131 W	189293.916	200277.527	0.99978597
SW COMMUNITY COLL CORS ARP	DH3874	673.650	645.113	35 20 52.40748 N	083 12 23.38897 W	185353.255	227392.744	0.99977276
FRANKLIN CORS ARP	DG4257	649.270	620.895	35 11 30.68622 N	083 23 41.74673 W	168802.916	209516.356	0.99977570
HAYWOOD CORS ARP	DE8228	838.220	809.314	35 31 35.39633 N	082 55 30.12730 W	204104.221	253736.164	0.99975705
PARI_OBS_NC_2008 CORS ARP	DM6192	909.630	880.094	35 12 06.96417 N	082 52 20.90284 W	167939.378	257095.138	0.99973486
NCBT		806.721	835.560	35 28 21.62542 N	082 53 40.58442 W	198028.964	256259.359	0.99975341
MARSHALL CORS ARP	DG7400	590.850	560.633	35 48 47.31356 N	082 41 22.67321 W	235064.443	276250.707	0.99983251
BURNSVILLE 2007 CORS ARP	DL6201	778.830	748.693	35 54 29.30454 N	082 20 49.87834 W	244501.699	307532.708	0.99982060
SWANNANOA CORS ARP	DG5311	689.830	659.842	35 35 46.03847 N	082 25 24.22964 W	210140.053	299464.372	0.99978706
HENDERSONVILLE CORS ARP	DK7853	684.850	654.472	35 21 21.89173 N	082 30 03.99653 W	183772.967	291488.002	0.99977154
NEWLAND 2007 CORS ARP	DM3991	1155.410	1124.527	36 04 39.95811 N	081 54 40.29398 W	262073.985	347419.061	0.99979994
MARION CORS ARP	DE8230	398.800	366.984	35 39 13.38510 N	081 57 16.17206 W	215162.325	342120.619	0.99983954
SPINDALE CORS ARP	DK4043	334.650	302.765	35 21 55.83430 N	081 54 57.34807 W	183099.887	344671.752	0.99982704
MORGANTON CORS ARP	DH7137	377.000	344.831	35 42 27.07386 N	081 39 23.99857 W	220367.093	369236.777	0.99985003
HICKORY CORS ARP	DM3523	358.510	326.299	35 44 31.01014 N	081 18 30.93483 W	223397.889	400811.751	0.99985789
SHELBY CORS ARP	DG7404	296.210	264.465	35 16 53.64241 N	081 29 28.11569 W	172739.799	383023.692	0.99983123
STATESVILLE CORS ARP	DK7549	261.190	228.842	35 51 19.72891 N	080 50 55.47790 W	235120.895	442629.732	0.99989208
MOORESVILLE CORS ARP	DH3838	297.570	266.205	35 34 46.87707 N	080 48 12.53662 W	204453.424	446161.276	0.99984714
GASTON CORS ARP	DE8425	245.140	213.712	35 18 39.79151 N	081 11 19.54124 W	175361.640	410593.642	0.99983959
I77 WELCOME CNTR CORS ARP	DF6318	187.950	157.556	35 07 21.25422 N	080 54 58.46768 W	153944.753	434964.997	0.99985039
NC49 BASE ARP	DP7098	209.768	240.180	35 18 24.69907 N	080 43 48.70762 W	174073.643	452274.604	0.99984013
MONROE CORS ARP	DF5880	174.600	144.332	34 58 54.77687 N	080 31 25.79009 W	137720.671	470484.517	0.99986097
POLKTON CORS ARP	DG7402	115.530	84.929	34 59 33.17297 N	080 10 37.85763 W	138473.153	502143.744	0.99986944
ROCKINGHAM CORS ARP	DM3995	122.950	91.872	34 57 51.98780 N	079 47 47.74087 W	135010.039	536859.244	0.99987067
NCRF		51.567	84.270	34 58 45.00929 N	79 13 04.01644 W	136373.746	589717.557	0.99987575
CARTHAGE CORS ARP	DG5938	181.000	149.613	35 20 30.04880 N	079 23 05.08515 W	176632.942	574629.599	0.99985034
TROY CORS ARP	DK4045	174.590	144.044	35 22 01.84517 N	079 52 12.77094 W	179740.437	530528.389	0.99985200
ASHEBORO 2 CORS ARP	DL6900	240.790	210.381	35 37 49.38501 N	079 45 53.75304 W	208859.939	540319.797	0.99986134
HIGH POINT CORS ARP	AI4198	299.220	267.948	35 57 56.48686 N	080 00 48.93737 W	246260.723	518178.455	0.99990805
LEXINGTON CORS ARP	DG5757	225.340	194.102	35 48 53.14318 N	080 13 46.20206 W	229736.512	498497.891	0.99989030
SALISBURY CORS ARP	DN5840	206.250	174.906	35 42 41.69212 N	080 25 55.99488 W	218535.902	480015.188	0.99987726
JORDAN LAKE CORS ARP	DL3891	77.430	45.996	35 46 52.49646 N	079 02 03.92766 W	225330.877	606489.109	0.99990797
SANFORD CORS ARP	AM7024	127.140	95.450	35 28 24.67784 N	079 09 28.98436 W	191202.330	595258.352	0.99986507

Acronyms, Abbreviations, and Definitions

ARP - Antenna Reference Point

CORS - Continuous Operating Reference Station

DMS - Degrees Minutes Seconds

m – Meter

PID - Permanent Identifier

SPC - State Plane Coordinates

Statistical Definitions:

Min ΔX / ΔY – These statistics represent the change in value between the X(Y)-coordinate location in the photo and X(Y)-coordinate location in the survey. The minimum of each simply represents the smallest value out of all of the analyzed locations. This component of the statistics can be used to show which user entered locations most closely correspond to the surveyed points.

Max ΔX / ΔY – These statistics represent the change in value between the X(Y)-coordinate location in the photo and X(Y)-coordinate location in the survey. The maximum value of each represents the largest value out of all of the analyzed locations. Maximum values can be used to show which user entered locations most closely correspond to the surveyed points.

Mean ΔX / ΔY - The statistics of the mean ΔX and mean ΔY are intended to show the average values of the ΔX and ΔY. These statistics show the change in value between the X(Y)-coordinate location in the photo and X(Y)-coordinate location in the survey. The mean values can be used to show the average off-sets of all of the analyzed locations

RMSE X / Y / H - The RMSE is used to describe accuracy encompassing both random and systematic errors. RMSE is the square root of the square of the difference between a true test point and an interpolated test point divided by the total number of test points in the arithmetic mean. RMSE X measures RMSE in the X direction only, and similarly RMSE Y measures RMSE in the Y direction only. RMSE H takes both X and Y directions into account, and measures the RMSE in a straight line between the true test point and the interpolated test point.

NSSDA – Horizontal accuracy standard adopted by the National Standard for Spatial Data Accuracy, computed utilizing the $RMSE_x$ and $RMSE_y$ values.

No. Obs. – Number of observations

CE 90 and CE 95 - Circular Error probable, defined as a circle, centered about the mean, whose boundary is expected to include a certain percentage of the population within it. In the case of CE90, 90% of the population is expected to be included within the circular radius and in the case of CE95, 95% of the population is expected to be included within the circular radius.

CI – Confidence Interval, which describes the uncertainty associated with a sampling method.