



Adam Plumley &lt;apsurveying@gmail.com&gt;

**OPUS solution : 33900300.16o OP1454255862527**

1 message

**opus** <opus@ngs.noaa.gov>  
 Reply-To: ngs.opus@noaa.gov  
 To: apsurveying@gmail.com

Sun, Jan 31, 2016 at 10:58 AM

FILE: 33900300.16o OP1454255862527

1008 NOTE: Antenna offsets supplied by the user were <=0. Coordinates  
 1008 returned will be for the antenna reference point (ARP).  
 1008  
 2005 NOTE: The IGS precise and IGS rapid orbits were not available  
 2005 at processing time. The IGS ultra-rapid orbit was/will be used to  
 2005 process the data.  
 2005

**NGS OPUS SOLUTION REPORT**  
 =====

All computed coordinate accuracies are listed as peak-to-peak values.  
 For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: [apsurveying@gmail.com](mailto:apsurveying@gmail.com) DATE: January 31, 2016  
 RINEX FILE: 3390030n.16o TIME: 15:58:27 UTC

SOFTWARE: page5 1209.04 [master92.pl](#) 022814 START: 2016/01/30 13:57:00  
 EPHEMERIS: igu18816.eph [ultra-rapid] STOP: 2016/01/30 18:10:00  
 NAV FILE: brdc0300.16n OBS USED: 9774 / 10968 : 89%  
 ANT NAME: SPP68410\_10 NONE # FIXED AMB: 52 / 55 : 95%  
 ARP HEIGHT: 0.000 OVERALL RMS: 0.015(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2016.0811)

X:	765721.674(m)	0.009(m)	765720.852(m)	0.009(m)
Y:	-5144667.514(m)	0.010(m)	-5144666.042(m)	0.010(m)
Z:	3679526.408(m)	0.004(m)	3679526.296(m)	0.004(m)

LAT:	35 27 28.63429	0.002(m)	35 27 28.66101	0.002(m)
E LON:	278 27 56.29705	0.010(m)	278 27 56.27340	0.010(m)
W LON:	81 32 3.70295	0.010(m)	81 32 3.72660	0.010(m)
EL HGT:	271.083(m)	0.010(m)	269.733(m)	0.010(m)
ORTHO HGT:	302.981(m)	0.022(m)	[NAVD88 (Computed using GEOID12B)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 17)	SPC (3200 NC )
Northing (Y) [meters]	3923961.512	192400.109
Easting (X) [meters]	451511.586	379593.155
Convergence [degrees]	-0.30999227	-1.46275832
Point Scale	0.99962897	0.99987904
Combined Factor	0.99958644	0.99983650

US NATIONAL GRID DESIGNATOR: 17SMV5151123961(NAD 83)

## BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7137	NCMG MORGANTON CORS ARP	N354227.073	W0813923.998	29827.7
DK4043	NCSP SPINDALE CORS ARP	N352155.834	W0815457.348	36144.7
DG7404	NCSH SHELBY CORS ARP	N351653.642	W0812928.115	19960.7

## NEAREST NGS PUBLISHED CONTROL POINT

FA4968	GRAPE	N352809.575	W0813026.808	2749.2
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## BASE STATION INFORMATION

STATION NAME: ncmg a 2 (Morganton; Morganton, North Carolina USA)

MONUMENT: NO DOMES NUMBER

XYZ	752408.0543	-5130405.9081	3702089.6628	MON @ 2005.0000 (M)
XYZ	-0.0143	0.0010	0.0007	VEL (M/YR)
NEU	0.0000	0.0000	0.0000	MON TO ARP (M)
NEU	0.0011	-0.0003	0.0668	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	0.0007	0.0578	ARP TO L2 PHASE CENTER (M)
XYZ	-0.1582	0.0106	0.0081	VEL TIMES 11.0794 YRS
XYZ	0.0000	0.0000	0.0000	MON TO ARP
XYZ	0.0075	-0.0530	0.0399	ARP TO L1 PHASE CENTER
XYZ	752407.9035	-5130405.9506	3702089.7108	L1 PHS CEN @ 2016.0811
XYZ	-0.0000	-0.0000	-0.0000	+ XYZ ADJUSTMENTS
XYZ	752407.9035	-5130405.9506	3702089.7108	NEW L1 PHS CEN @ 2016.0811
XYZ	752407.8961	-5130405.8975	3702089.6709	NEW ARP @ 2016.0811
XYZ	752407.8961	-5130405.8975	3702089.6709	NEW MON @ 2016.0811
LLH	35 42 27.10076	278 20 35.97743	343.5441	NEW L1 PHS CEN @ 2016.0811
LLH	35 42 27.10072	278 20 35.97744	343.4773	NEW ARP @ 2016.0811
LLH	35 42 27.10072	278 20 35.97744	343.4773	NEW MON @ 2016.0811

STATION NAME: ncsp a 2 (Spindale; Spindale, North Carolina USA)

MONUMENT: NO DOMES NUMBER

XYZ	732282.1811	-5155561.2376	3671185.0843	MON @ 2005.0000 (M)
XYZ	-0.0145	0.0006	0.0015	VEL (M/YR)
NEU	0.0000	0.0000	0.0000	MON TO ARP (M)
NEU	0.0011	-0.0003	0.0668	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	0.0007	0.0578	ARP TO L2 PHASE CENTER (M)
XYZ	-0.1605	0.0066	0.0162	VEL TIMES 11.0794 YRS
XYZ	0.0000	0.0000	0.0000	MON TO ARP
XYZ	0.0072	-0.0533	0.0396	ARP TO L1 PHASE CENTER
XYZ	732282.0278	-5155561.2843	3671185.1400	L1 PHS CEN @ 2016.0811
XYZ	-0.0000	0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	732282.0278	-5155561.2843	3671185.1400	NEW L1 PHS CEN @ 2016.0811
XYZ	732282.0206	-5155561.2310	3671185.1005	NEW ARP @ 2016.0811
XYZ	732282.0206	-5155561.2310	3671185.1005	NEW MON @ 2016.0811
LLH	35 21 55.86093	278 5 2.62776	301.4752	NEW L1 PHS CEN @ 2016.0811
LLH	35 21 55.86089	278 5 2.62777	301.4084	NEW ARP @ 2016.0811
LLH	35 21 55.86089	278 5 2.62777	301.4084	NEW MON @ 2016.0811

STATION NAME: ncsh a 3 (SHELBY; Shelby, North Carolina, U.S.A.)

MONUMENT: NO DOMES NUMBER

XYZ	771276.8226	-5155285.3238	3663564.0465	MON @ 2005.0000 (M)
XYZ	-0.0132	-0.0003	0.0017	VEL (M/YR)
NEU	0.0000	0.0000	0.0000	MON TO ARP (M)
NEU	0.0011	-0.0003	0.0668	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	0.0007	0.0578	ARP TO L2 PHASE CENTER (M)
XYZ	-0.1464	-0.0030	0.0191	VEL TIMES 11.0794 YRS

XYZ	0.0000	0.0000	0.0000	MON TO ARP
XYZ	0.0077	-0.0533	0.0395	ARP TO L1 PHASE CENTER
XYZ	771276.6839	-5155285.3801	3663564.1050	L1 PHS CEN @ 2016.0811
XYZ	0.0000	0.0000	-0.0000	+ XYZ ADJUSTMENTS
XYZ	771276.6839	-5155285.3801	3663564.1050	NEW L1 PHS CEN @ 2016.0811
XYZ	771276.6762	-5155285.3268	3663564.0656	NEW ARP @ 2016.0811
XYZ	771276.6762	-5155285.3268	3663564.0656	NEW MON @ 2016.0811
LLH	35 16 53.66905	278 30 31.86091	263.1746	NEW L1 PHS CEN @ 2016.0811
LLH	35 16 53.66901	278 30 31.86092	263.1078	NEW ARP @ 2016.0811
LLH	35 16 53.66901	278 30 31.86092	263.1078	NEW MON @ 2016.0811

## REMOTE STATION INFORMATION

STATION NAME: 3390 1

MONUMENT: NO DOMES NUMBER

XYZ	765720.8810	-5144666.1754	3679526.4472	MON @ 2016.0808 (M)
NEU	-0.0012	0.0010	0.0001	MON TO ARP (M)
NEU	0.0012	-0.0010	0.1008	ARP TO L1 PHASE CENTER (M)
NEU	-0.0009	0.0002	0.0992	ARP TO L2 PHASE CENTER (M)
XYZ	0.0011	-0.0006	-0.0009	MON TO ARP
XYZ	0.0110	-0.0806	0.0594	ARP TO L1 PHASE CENTER
XYZ	765720.8931	-5144666.2566	3679526.5057	L1 PHS CEN @ 2016.0811

BASELINE NAME: ncmg 3390

XYZ	-0.0334	0.1284	-0.1495	+ XYZ ADJUSTMENTS
XYZ	765720.8597	-5144666.1282	3679526.3561	NEW L1 PHS CEN @ 2016.0811
XYZ	765720.8487	-5144666.0476	3679526.2967	NEW ARP @ 2016.0811
XYZ	765720.8476	-5144666.0470	3679526.2977	NEW MON @ 2016.0811
LLH	35 27 28.66097	278 27 56.27320	269.8384	NEW L1 PHS CEN @ 2016.0811
LLH	35 27 28.66093	278 27 56.27323	269.7376	NEW ARP @ 2016.0811
LLH	35 27 28.66097	278 27 56.27320	269.7376	NEW MON @ 2016.0811

BASELINE NAME: ncsp 3390

XYZ	-0.0242	0.1327	-0.1505	+ XYZ ADJUSTMENTS
XYZ	765720.8689	-5144666.1240	3679526.3552	NEW L1 PHS CEN @ 2016.0811
XYZ	765720.8578	-5144666.0433	3679526.2958	NEW ARP @ 2016.0811
XYZ	765720.8568	-5144666.0427	3679526.2967	NEW MON @ 2016.0811
LLH	35 27 28.66100	278 27 56.27358	269.8355	NEW L1 PHS CEN @ 2016.0811
LLH	35 27 28.66096	278 27 56.27362	269.7347	NEW ARP @ 2016.0811
LLH	35 27 28.66100	278 27 56.27358	269.7347	NEW MON @ 2016.0811

BASELINE NAME: ncsh 3390

XYZ	-0.0292	0.1383	-0.1535	+ XYZ ADJUSTMENTS
XYZ	765720.8639	-5144666.1183	3679526.3522	NEW L1 PHS CEN @ 2016.0811
XYZ	765720.8529	-5144666.0376	3679526.2928	NEW ARP @ 2016.0811
XYZ	765720.8518	-5144666.0371	3679526.2937	NEW MON @ 2016.0811
LLH	35 27 28.66104	278 27 56.27342	269.8286	NEW L1 PHS CEN @ 2016.0811
LLH	35 27 28.66100	278 27 56.27346	269.7278	NEW ARP @ 2016.0811
LLH	35 27 28.66104	278 27 56.27342	269.7278	NEW MON @ 2016.0811

## G-FILES

Axx2016 130 16 130

B2016 1301357 16 13018 9 1 page5 v1209.04IGS 126 1 2 27NGS 2016 131IFDDPX  
 IIGS08\_1881 IGS 20160124  
 C00090002 -133129515 7 142601495 26 225633733 16 X0306A3390X0306ANCMG  
 D 1 2 -7173398 1 3 4554189 2 3 -8496218

Axx2016 130 16 130

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 IIGS08\_1881 IGS 20160124

C00090001 -334388362 7 -108951883 23 -83411962 16 X0306A3390X0306ANCSP  
D 1 2 -3442332 1 3 3946994 2 3 -9221216

Axx2016 130 16 130

B2016 1301357 16 13018 9 1 page5 v1209.04IGS 126 1 2 27NGS 2016 131IFDDPX  
IIGS08\_1881 IGS 20160124  
C00090003 55558244 5 -106192898 23 -159622281 15 X0306A3390X0306ANCsh  
D 1 2 -6741437 1 3 4545461 2 3 -8246563

#### POST-FIT RMS BY SATELLITE VS. BASELINE

	OVERALL	05	10	13	14	15	18	20	21
ncmg-3390	0.016	0.022	0.015	0.018	0.013	0.015	...	0.014	0.013
	22	24	25	27	29	31			
ncmg-3390	0.023	0.014	0.025	0.023	0.017	0.017			

	OVERALL	05	10	13	14	15	18	20	21
ncsp-3390	0.014	0.024	0.012	0.016	0.013	0.015	...	0.013	0.011
	22	24	25	27	29	31			
ncsp-3390	0.016	0.013	0.021	0.022	0.017	0.015			

	OVERALL	02	05	10	13	14	15	18	20
ncsh-3390	0.014	...	0.026	0.013	0.015	0.011	0.014	...	0.012
	21	22	24	25	27	29	31		
ncsh-3390	0.011	0.017	0.013	0.022	0.017	0.016	0.017		

#### OBS BY SATELLITE VS. BASELINE

	OVERALL	05	10	13	14	15	18	20	21
ncmg-3390	3290	79	346	223	344	418	...	393	498
	22	24	25	27	29	31			
ncmg-3390	138	475	49	95	149	83			
	OVERALL	05	10	13	14	15	18	20	21
ncsp-3390	3201	42	316	212	343	411	...	402	473
	22	24	25	27	29	31			
ncsp-3390	168	456	29	81	180	88			
	OVERALL	02	05	10	13	14	15	18	20
ncsh-3390	3283	...	96	345	211	337	422	...	399
	21	22	24	25	27	29	31		
ncsh-3390	481	179	452	58	62	159	82		

Covariance Matrix for the xyz OPUS Position (meters^2).

0.0000002733	-0.0000000586	0.0000000287
-0.0000000586	0.0000038533	-0.0000002172
0.0000000287	-0.0000002172	0.0000016378

Covariance Matrix for the enu OPUS Position (meters^2).

0.0000003339	0.0000002658	-0.0000003819
0.0000002658	0.0000021500	-0.0000009431
-0.0000003819	-0.0000009431	0.0000032806

Horizontal network accuracy = 0.00295 meters.

Vertical network accuracy = 0.00355 meters.

#### Derivation of NAD 83 vector components

Position of reference station ARP in NAD\_83(2011)(EPOCH:2010.0000).

Xa(m)	Ya(m)	Za(m)
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NCMG	752408.72234	-5130407.37533	3702089.78851	2010.00
NCSP	732282.84673	-5155562.70994	3671185.21715	2010.00
NCSH	771277.49477	-5155286.80352	3663564.18032	2010.00

Position of reference station monument in NAD\_83(2011)(EPOCH:2010.0000).

	Xr(m)	Yr(m)	Zr(m)	
NCMG	752408.72234	-5130407.37533	3702089.78851	2010.00
NCSP	732282.84673	-5155562.70994	3671185.21715	2010.00
NCSH	771277.49477	-5155286.80352	3663564.18032	2010.00

Velocity of reference station monument in NAD\_83(2011)(EPOCH:2010.0000).

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
NCMG	-0.01430	0.00100	0.00070
NCSP	-0.01450	0.00060	0.00150
NCSH	-0.01320	-0.00030	0.00170

Vectors from unknown station monument to reference station monument in NAD\_83(2011)(EPOCH:2010.0000).

	Xr-X= DX(m)	Yr-Y= DY(m)	Zr-Z= DZ(m)	
NCMG	-13312.95166	14260.13867	22563.38051	2010.00
NCSP	-33438.82727	-10895.19594	-8341.19085	2010.00
NCSH	5555.82077	-10619.28952	-15962.22768	2010.00

#### STATE PLANE COORDINATES - U.S. Survey Foot

SPC (3200 NC )

Northing (Y) [feet]	631232.691
Easting (X) [feet]	1245381.876
Convergence [degrees]	-1.46275832
Point Scale	0.99987904
Combined Factor	0.99983650

**\*\* Orthometric Heights Above Future Geopotential Datum.**

Prototype orthometric heights are now being made available as a precursor to the completion of GRAV-D and the replacement of NAVD 88 with a new geopotential reference system. The following height reflects the current best estimate of the true orthometric height, based on the existing gravimetric geoid model. This height is subject to change as data and modeling for the gravimetric geoid change throughout the lifetime of the GRAV-D project, or as new realizations of the ITRF are adopted. However, at the completion of GRAV-D, these heights will supersede the NAVD 88 heights

APPROX ORTHO HGT: 302.708 (m) [PROTOTYPE (Computed using USGG2012,GRS80,IGS08)]

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.