



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

**OPUS solution : 33900301.16o OP1454256009758**

1 message

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

Sun, Jan 31, 2016 at 11:01 AM

FILE: 33900301.16o OP1454256009758

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)  
 RINEX FILE: 3390030s.16o

DATE: January 31, 2016  
 TIME: 16:00:51 UTC

SOFTWARE: page5 1209.04 [master91.pl](#) 022814 START: 2016/01/30 18:39:00  
 EPHEMERIS: igu18816.eph [ultra-rapid] STOP: 2016/01/30 22:43:00  
 NAV FILE: brdc0300.16n OBS USED: 8496 / 9763 : 87%  
 ANT NAME: SPP68410\_10 NONE # FIXED AMB: 58 / 65 : 89%  
 ARP HEIGHT: 0.000 OVERALL RMS: 0.015(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2016.0816)

X:	765721.806(m)	0.008(m)	765720.984(m)	0.008(m)
Y:	-5144667.896(m)	0.012(m)	-5144666.424(m)	0.012(m)
Z:	3679525.837(m)	0.012(m)	3679525.725(m)	0.012(m)

LAT:	35 27 28.61172	0.003(m)	35 27 28.63844	0.003(m)
E LON:	278 27 56.29999	0.007(m)	278 27 56.27634	0.007(m)
W LON:	81 32 3.70001	0.007(m)	81 32 3.72366	0.007(m)
EL HGT:	271.075(m)	0.018(m)	269.725(m)	0.018(m)
ORTHO HGT:	302.973(m)	0.033(m)	[NAVD88 (Computed using GEOID12B)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 17)	SPC (3200 NC )
Northing (Y) [meters]	3923960.816	192399.412
Easting (X) [meters]	451511.657	379593.212
Convergence [degrees]	-0.30999175	-1.46275785
Point Scale	0.99962897	0.99987904
Combined Factor	0.99958644	0.99983650

US NATIONAL GRID DESIGNATOR: 17SMV5151123960(NAD 83)

## BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DG7404	NCSH SHELBY CORS ARP	N351653.642	W0812928.115	19960.0
DK4043	NCSP SPINDALE CORS ARP	N352155.834	W0815457.348	36144.5
DH7137	NCMG MORGANTON CORS ARP	N354227.073	W0813923.998	29828.4

## NEAREST NGS PUBLISHED CONTROL POINT

FA4968	GRAPE	N352809.575	W0813026.808	2749.4
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## BASE STATION INFORMATION

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 11.0799 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 @ 2016.0816
XYZ	0.0000	-0.0000	-0.0000	+ XYZ ADJUSTMENTS
XYZ	771276.6839	-5155285.3802	3663564.1050	NEW L1 PHS CEN @ 2016.0816
XYZ	771276.6762	-5155285.3268	3663564.0656	NEW ARP @ 2016.0816
XYZ	771276.6762	-5155285.3268	3663564.0656	NEW MON @ 2016.0816
LLH	35 16 53.66905	278 30 31.86091	263.1746	NEW L1 PHS CEN @ 2016.0816
LLH	35 16 53.66901	278 30 31.86092	263.1078	NEW ARP @ 2016.0816
LLH	35 16 53.66901	278 30 31.86092	263.1078	NEW MON @ 2016.0816

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 11.0799 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 @ 2016.0816
XYZ	0.0000	0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	732282.0278	-5155561.2843	3671185.1400	NEW L1 PHS CEN @ 2016.0816
XYZ	732282.0206	-5155561.2310	3671185.1005	NEW ARP @ 2016.0816
XYZ	732282.0206	-5155561.2310	3671185.1005	NEW MON @ 2016.0816
LLH	35 21 55.86093	278 5 2.62776	301.4752	NEW L1 PHS CEN @ 2016.0816
LLH	35 21 55.86089	278 5 2.62777	301.4084	NEW ARP @ 2016.0816
LLH	35 21 55.86089	278 5 2.62777	301.4084	NEW MON @ 2016.0816

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 11.0799 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 @ 2016.0816
XYZ	-0.0000	-0.0000	-0.0000	+ XYZ ADJUSTMENTS
XYZ	752407.9035	-5130405.9506	3702089.7108	NEW L1 PHS CEN @ 2016.0816
XYZ	752407.8961	-5130405.8975	3702089.6709	NEW ARP @ 2016.0816
XYZ	752407.8961	-5130405.8975	3702089.6709	NEW MON @ 2016.0816
LLH	35 42 27.10076	278 20 35.97743	343.5441	NEW L1 PHS CEN @ 2016.0816
LLH	35 42 27.10072	278 20 35.97744	343.4773	NEW ARP @ 2016.0816
LLH	35 42 27.10072	278 20 35.97744	343.4773	NEW MON @ 2016.0816

## REMOTE STATION INFORMATION

STATION NAME: 3390 1

MONUMENT: NO DOMES NUMBER

XYZ	765721.0598	-5144666.6062	3679525.8963	MON @ 2016.0814 (M)
NEU	-0.0012	0.0010	0.0000	MON TO ARP (M)
NEU	0.0012	-0.0010	0.1008	ARP TO L1 PHASE CENTER (M)
NEU	-0.0009	0.0002	0.0991	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	765721.0719	-5144666.6874	3679525.9548	L1 PHS CEN @ 2016.0816

BASELINE NAME: ncsh 3390

XYZ	-0.0717	0.1751	-0.1652	+ XYZ ADJUSTMENTS
XYZ	765721.0002	-5144666.5123	3679525.7896	NEW L1 PHS CEN @ 2016.0816
XYZ	765720.9892	-5144666.4316	3679525.7302	NEW ARP @ 2016.0816
XYZ	765720.9881	-5144666.4311	3679525.7311	NEW MON @ 2016.0816
LLH	35 27 28.63846	278 27 56.27647	269.8360	NEW L1 PHS CEN @ 2016.0816
LLH	35 27 28.63842	278 27 56.27650	269.7353	NEW ARP @ 2016.0816
LLH	35 27 28.63846	278 27 56.27647	269.7352	NEW MON @ 2016.0816

BASELINE NAME: ncsp 3390

XYZ	-0.0746	0.1846	-0.1725	+ XYZ ADJUSTMENTS
XYZ	765720.9973	-5144666.5029	3679525.7823	NEW L1 PHS CEN @ 2016.0816
XYZ	765720.9863	-5144666.4222	3679525.7229	NEW ARP @ 2016.0816
XYZ	765720.9852	-5144666.4216	3679525.7238	NEW MON @ 2016.0816
LLH	35 27 28.63845	278 27 56.27641	269.8238	NEW L1 PHS CEN @ 2016.0816
LLH	35 27 28.63841	278 27 56.27645	269.7231	NEW ARP @ 2016.0816
LLH	35 27 28.63845	278 27 56.27641	269.7230	NEW MON @ 2016.0816

BASELINE NAME: ncmg 3390

XYZ	-0.0800	0.1866	-0.1776	+ XYZ ADJUSTMENTS
XYZ	765720.9919	-5144666.5008	3679525.7772	NEW L1 PHS CEN @ 2016.0816
XYZ	765720.9808	-5144666.4201	3679525.7178	NEW ARP @ 2016.0816
XYZ	765720.9798	-5144666.4196	3679525.7187	NEW MON @ 2016.0816
LLH	35 27 28.63837	278 27 56.27620	269.8185	NEW L1 PHS CEN @ 2016.0816
LLH	35 27 28.63833	278 27 56.27624	269.7178	NEW ARP @ 2016.0816
LLH	35 27 28.63837	278 27 56.27620	269.7177	NEW MON @ 2016.0816

## G-FILES

Axx2016 130 16 130

B2016 1301839 16 1302242 1 page5 v1209.04IGS 126 1 2 27NGS 2016 131IFDDPX  
 IIGS08\_1881 IGS 20160124  
 C00090003 55556881 7 -106188958 22 -159616656 17 X0306A3390X0306ANCSH  
 D 1 2 -6082768 1 3 3314728 2 3 -8332355

Axx2016 130 16 130

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C00090001 -334389646 9 -108948094 25 -83406233 18 X0306A3390X0306ANCSP  
D 1 2 -5408625 1 3 5240531 2 3 -9437605

Axx2016 130 16 130

B2016 1301839 16 1302242 1 page5 v1209.04IGS 126 1 2 27NGS 2016 131IFDDPX  
IIGS08\_1881 IGS 20160124  
C00090002 -133130837 8 142605220 24 225639522 17 X0306A3390X0306ANCMG  
D 1 2 -6583481 1 3 3310293 2 3 -8211016

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

	OVERALL	01	03	10	14	16	18	22	23
ncsh-3390	0.015	0.023	0.015	0.012	0.012	0.013	0.016	0.012	0.021
	24	25	26	27	29	31			
ncsh-3390	...	0.014	0.011	0.017	0.021	...			

	OVERALL	01	03	10	14	16	18	22	23
ncsp-3390	0.015	0.019	0.017	0.011	0.011	0.013	0.014	0.011	0.018
	24	25	26	27	29	31			
ncsp-3390	...	0.014	0.011	0.021	0.023	...			

	OVERALL	01	03	10	14	16	18	22	23
ncmg-3390	0.016	0.022	0.018	0.011	0.012	0.012	0.015	0.011	0.020
	24	25	26	27	29	31			
ncmg-3390	...	0.014	0.011	0.015	0.025	...			

#### OBS BY SATELLITE VS. BASELINE

	OVERALL	01	03	10	14	16	18	22	23
ncsh-3390	2812	95	241	245	447	259	97	418	151
	24	25	26	27	29	31			
ncsh-3390	...	300	353	24	182	...			

	OVERALL	01	03	10	14	16	18	22	23
ncsp-3390	2847	89	286	238	440	263	109	431	137
	24	25	26	27	29	31			
ncsp-3390	...	303	364	18	169	...			

	OVERALL	01	03	10	14	16	18	22	23
ncmg-3390	2837	116	286	251	448	260	101	424	127
	24	25	26	27	29	31			
ncmg-3390	...	291	359	15	159	...			

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

0.0000004311	-0.0000000759	0.0000000376
-0.0000000759	0.0000037444	-0.0000002381
0.0000000376	-0.0000002381	0.0000020044

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

0.0000004808	0.0000002384	-0.0000003333
0.0000002384	0.0000023409	-0.0000007167
-0.0000003333	-0.0000007167	0.0000033583

Horizontal network accuracy = 0.00310 meters.

Vertical network accuracy = 0.00359 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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NCSH	771277.49477	-5155286.80352	3663564.18032	2010.00
NCSP	732282.84673	-5155562.70994	3671185.21715	2010.00
NCMG	752408.72234	-5130407.37533	3702089.78851	2010.00

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

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

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

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

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)	
NCSH	5555.68877	-10618.90752	-15961.65668	2010.00
NCSP	-33438.95927	-10894.81394	-8340.61985	2010.00
NCMG	-13313.08366	14260.52067	22563.95151	2010.00

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

SPC (3200 NC )

Northing (Y) [feet]	631230.404
Easting (X) [feet]	1245382.063
Convergence [degrees]	-1.46275785
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: 302.700 (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.