

OPUS solution : 018697_14_213_A0.14O OP1407513745911

opus <opus@ngs.noaa.gov>

Fri 8/8/2014 10:04 AM

To:Chad Mozol <Chad.Mozol@neciusa.com>;

FILE: 018697_14_213_A0.14O OP1407513745911

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: cmozol@neciusa.com DATE: August 08, 2014
 RINEX FILE: 0186213t.14o TIME: 16:04:14 UTC

SOFTWARE: page5 1209.04 master90.pl 022814 START: 2014/08/01 19:42:00
 EPHEMERIS: igr18035.eph [rapid] STOP: 2014/08/01 23:00:00
 NAV FILE: brdc2130.14n OBS USED: 6123 / 7280 : 84%
 ANT NAME: CHCX90D-OPUS NONE # FIXED AMB: 38 / 39 : 97%
 ARP HEIGHT: 2.1000 OVERALL RMS: 0.018(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2014.5833)

X:	-1368595.674(m)	0.004(m)	-1368596.548(m)	0.004(m)
Y:	-4052661.695(m)	0.015(m)	-4052660.470(m)	0.015(m)
Z:	4716807.646(m)	0.001(m)	4716807.635(m)	0.001(m)

LAT:	47 59 15.31652	0.009(m)	47 59 15.33747	0.009(m)
E LON:	251 20 24.08824	0.009(m)	251 20 24.02941	0.009(m)
W LON:	108 39 35.91176	0.009(m)	108 39 35.97059	0.009(m)
EL HGT:	1150.599(m)	0.009(m)	1150.001(m)	0.009(m)
ORTHO HGT:	1165.904(m)	0.018(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 12) SPC (2500 MT)

Northing (Y) [meters]	5317570.373	415652.516
Easting (X) [meters]	674592.173	662671.978
Convergence [degrees]	1.73907487	0.61448146
Point Scale	0.99997457	0.99953779
Combined Factor	0.99979427	0.99935757

US NATIONAL GRID DESIGNATOR: 12TXU7459217570(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DI2257	P049 ARMINGTON_MT2006	CORS ARP	N472059.850 W1105422.382	183006.0
DI3425	P052 LRRNCHJRDNMT2006	CORS ARP	N472229.026 W1070107.185	140835.2
DM7133	MTLW LEWISTOWN	CORS ARP	N470314.929 W1092633.764	119374.3

NEAREST NGS PUBLISHED CONTROL POINT

SR0247	P 135	N475837.	W1084023.	1534.2
--------	-------	----------	-----------	--------

BASE STATION INFORMATION

STATION NAME: p049 a 1 (Armington_MT2006; Belt, MT United States)

MONUMENT: NO DOMES NUMBER

XYZ -1545099.6822 -4044895.8653 4669084.6330 MON @ 2005.0000 (M)
 XYZ -0.0157 -0.0002 -0.0067 VEL (M/YR)
 NEU -0.0000 0.0000 0.0083 MON TO ARP (M)
 NEU 0.0012 0.0008 0.0860 ARP TO L1 PHASE CENTER (M)
 NEU 0.0006 -0.0006 0.1183 ARP TO L2 PHASE CENTER (M)
 XYZ -0.1509 -0.0017 -0.0644 VEL TIMES 9.5824 YRS
 XYZ -0.0020 -0.0053 0.0061 MON TO ARP
 XYZ -0.0198 -0.0539 0.0640 ARP TO L1 PHASE CENTER
 XYZ -1545099.8549 -4044895.9261 4669084.6387 L1 PHS CEN @ 2014.5833
 XYZ -0.0000 -0.0000 -0.0000 + XYZ ADJUSTMENTS
 XYZ -1545099.8549 -4044895.9261 4669084.6386 NEW L1 PHS CEN @ 2014.5833
 XYZ -1545099.8351 -4044895.8722 4669084.5746 NEW ARP @ 2014.5833
 XYZ -1545099.8331 -4044895.8669 4669084.5685 NEW MON @ 2014.5833
 LLH 47 20 59.87007 249 5 37.55751 1186.1535 NEW L1 PHS CEN @ 2014.5833
 LLH 47 20 59.87003 249 5 37.55748 1186.0675 NEW ARP @ 2014.5833
 LLH 47 20 59.87003 249 5 37.55748 1186.0592 NEW MON @ 2014.5833

STATION NAME: p052 a 2 (LRRnchJrdnMT2006; Jordan, MT United States)

MONUMENT: NO DOMES NUMBER

XYZ -1266648.1846 -4138194.5676 4670709.5484 MON @ 2005.0000 (M)
 XYZ -0.0158 0.0003 -0.0057 VEL (M/YR)
 NEU -0.0000 0.0000 0.0083 MON TO ARP (M)
 NEU 0.0012 0.0008 0.0860 ARP TO L1 PHASE CENTER (M)
 NEU 0.0006 -0.0006 0.1183 ARP TO L2 PHASE CENTER (M)
 XYZ -0.1515 0.0031 -0.0549 VEL TIMES 9.5824 YRS
 XYZ -0.0016 -0.0054 0.0061 MON TO ARP
 XYZ -0.0161 -0.0551 0.0641 ARP TO L1 PHASE CENTER
 XYZ -1266648.3538 -4138194.6249 4670709.5637 L1 PHS CEN @ 2014.5833
 XYZ 0.0000 -0.0000 0.0000 + XYZ ADJUSTMENTS
 XYZ -1266648.3538 -4138194.6249 4670709.5637 NEW L1 PHS CEN @ 2014.5833
 XYZ -1266648.3378 -4138194.5698 4670709.4996 NEW ARP @ 2014.5833
 XYZ -1266648.3361 -4138194.5645 4670709.4935 NEW MON @ 2014.5833
 LLH 47 22 29.04864 252 58 52.75790 858.7208 NEW L1 PHS CEN @ 2014.5833

LLH 47 22 29.04860 252 58 52.75786 858.6349 NEW ARP @ 2014.5833
 LLH 47 22 29.04860 252 58 52.75786 858.6266 NEW MON @ 2014.5833

STATION NAME: mtlw a 1 (Lewistown; Lewistown, Montana USA)

MONUMENT: NO DOMES NUMBER

XYZ -1449333.3267 -4105829.8275 4646773.5579 MON @ 2005.0000 (M)
 XYZ -0.0160 -0.0003 -0.0053 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 -0.1538 -0.0033 -0.0505 VEL TIMES 9.5824 YRS
 XYZ 0.0000 0.0000 0.0000 MON TO ARP
 XYZ -0.0152 -0.0420 0.0496 ARP TO L1 PHASE CENTER
 XYZ -1449333.4957 -4105829.8728 4646773.5571 L1 PHS CEN @ 2014.5833
 XYZ -0.0000 -0.0000 -0.0000 + XYZ ADJUSTMENTS
 XYZ -1449333.4957 -4105829.8728 4646773.5571 NEW L1 PHS CEN @ 2014.5833
 XYZ -1449333.4806 -4105829.8307 4646773.5074 NEW ARP @ 2014.5833
 XYZ -1449333.4806 -4105829.8307 4646773.5074 NEW MON @ 2014.5833
 LLH 47 3 14.94992 250 33 26.17775 1236.4224 NEW L1 PHS CEN @ 2014.5833
 LLH 47 3 14.94988 250 33 26.17777 1236.3556 NEW ARP @ 2014.5833
 LLH 47 3 14.94988 250 33 26.17777 1236.3556 NEW MON @ 2014.5833

REMOTE STATION INFORMATION

STATION NAME: 0186 1

MONUMENT: NO DOMES NUMBER

XYZ -1368596.4822 -4052660.7904 4716807.2517 MON @ 2014.5831 (M)
 NEU -0.0011 0.0007 2.1000 MON TO ARP (M)
 NEU 0.0011 -0.0007 0.0893 ARP TO L1 PHASE CENTER (M)
 NEU 0.0007 -0.0031 0.1017 ARP TO L2 PHASE CENTER (M)
 XYZ -0.4493 -1.3326 1.5595 MON TO ARP
 XYZ -0.0195 -0.0556 0.0670 ARP TO L1 PHASE CENTER
 XYZ -1368596.9510 -4052662.1786 4716808.8783 L1 PHS CEN @ 2014.5833

BASELINE NAME: p049 0186

XYZ -0.0628 0.3115 0.3840 + XYZ ADJUSTMENTS
 XYZ -1368597.0138 -4052661.8671 4716809.2623 NEW L1 PHS CEN @ 2014.5833
 XYZ -1368596.9943 -4052661.8115 4716809.1953 NEW ARP @ 2014.5833
 XYZ -1368596.5450 -4052660.4789 4716807.6357 NEW MON @ 2014.5833
 LLH 47 59 15.33731 251 20 24.02969 1152.1962 NEW L1 PHS CEN @ 2014.5833
 LLH 47 59 15.33727 251 20 24.02972 1152.1070 NEW ARP @ 2014.5833
 LLH 47 59 15.33731 251 20 24.02969 1150.0070 NEW MON @ 2014.5833

BASELINE NAME: p052 0186

XYZ -0.0670 0.3234 0.3829 + XYZ ADJUSTMENTS
 XYZ -1368597.0180 -4052661.8552 4716809.2612 NEW L1 PHS CEN @ 2014.5833
 XYZ -1368596.9985 -4052661.7995 4716809.1941 NEW ARP @ 2014.5833
 XYZ -1368596.5492 -4052660.4670 4716807.6346 NEW MON @ 2014.5833
 LLH 47 59 15.33753 251 20 24.02931 1152.1887 NEW L1 PHS CEN @ 2014.5833
 LLH 47 59 15.33749 251 20 24.02934 1152.0995 NEW ARP @ 2014.5833
 LLH 47 59 15.33753 251 20 24.02931 1149.9995 NEW MON @ 2014.5833

BASELINE NAME: mtlw 0186

XYZ -0.0671 0.3262 0.3829 + XYZ ADJUSTMENTS
 XYZ -1368597.0181 -4052661.8524 4716809.2612 NEW L1 PHS CEN @ 2014.5833
 XYZ -1368596.9986 -4052661.7968 4716809.1942 NEW ARP @ 2014.5833
 XYZ -1368596.5493 -4052660.4642 4716807.6346 NEW MON @ 2014.5833
 LLH 47 59 15.33759 251 20 24.02926 1152.1870 NEW L1 PHS CEN @ 2014.5833
 LLH 47 59 15.33755 251 20 24.02929 1152.0978 NEW ARP @ 2014.5833
 LLH 47 59 15.33759 251 20 24.02926 1149.9978 NEW MON @ 2014.5833

G-FILES

Axx2014 8 1 14 8 1

B2014 8 11941 14 8 123 0 1 page5 v1209.04IGS 126 1 2 27NGS 2014 8 8IFDDPX
 IIGS08_1804 IGS 20140803
 C00090001-1765032881 19 77646120 34 -477230672 44 X2134A0186X2134AP049
 D 1 2 6308601 1 3 -5605183 2 3 -9592596

Axx2014 8 1 14 8 1

B2014 8 11941 14 8 123 0 1 page5 v1209.04IGS 126 1 2 27NGS 2014 8 8IFDDPX
 IIGS08_1804 IGS 20140803
 C00090005 1019482131 14 -855340975 30 -460981410 34 X2134A0186X2134AP052
 D 1 2 3629439 1 3 -6224984 2 3 -8883688

Axx2014 8 1 14 8 1

B2014 8 11941 14 8 123 0 1 page5 v1209.04IGS 126 1 2 27NGS 2014 8 8IFDDPX
 IIGS08_1804 IGS 20140803
 C00090003 -807369312 18 -531693665 39 -700341272 47 X2134A0186X2134AMTLW
 D 1 2 8817332 1 3 -7230624 2 3 -9341414

POST-FIT RMS BY SATELLITE VS. BASELINE

OVERALL 01 02 04 05 06 10 12 15
 p049-0186| 0.021 ... 0.017 0.024 0.036 ... 0.022 0.016 ...
 17 20 24 25 28 29
 p049-0186| 0.031 0.021 0.018 0.022 0.023 ...

OVERALL 01 02 04 05 06 10 12 15
 p052-0186| 0.017 ... 0.014 0.020 0.019 ... 0.017 0.014 ...
 17 20 24 25 28 29
 p052-0186| 0.018 0.014 0.018 0.017 0.026 ...

OVERALL 01 02 04 05 06 10 12 15
 mtlw-0186| 0.016 ... 0.013 0.018 0.023 ... 0.015 0.014 ...
 17 20 24 25 28 29
 mtlw-0186| 0.018 0.019 0.016 0.019 0.020 ...

OBS BY SATELLITE VS. BASELINE

OVERALL 01 02 04 05 06 10 12 15
 p049-0186| 2101 ... 347 261 78 ... 180 302 ...

	17	20	24	25	28	29			
p049-0186	281	25	351	137	139	...			
OVERALL	01	02	04	05	06	10	12	15	
p052-0186	2023	...	345	260	76	...	164	286	...
	17	20	24	25	28	29			
p052-0186	268	6	350	136	132	...			
OVERALL	01	02	04	05	06	10	12	15	
mtlw-0186	1999	...	327	260	65	...	163	301	...
	17	20	24	25	28	29			
mtlw-0186	263	7	341	136	136	...			

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

0.0000024111	0.0000003367	-0.0000004298
0.0000003367	0.0000102511	-0.0000011586
-0.0000004298	-0.0000011586	0.0000154533

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

0.0000030095	-0.0000015866	0.0000013896
-0.0000015866	0.0000110411	0.0000027661
0.0000013896	0.0000027661	0.0000140649

Horizontal network accuracy = 0.00685 meters.

Vertical network accuracy = 0.00735 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)	
P049	-1545098.96458	-4044897.09606	4669084.59181	2010.00
P052	-1266647.47169	-4138195.81057	4670709.52375	2010.00
MTLW	-1449332.61170	-4105831.06162	4646773.52520	2010.00

Position of reference station monument in NAD_83(2011)(EPOCH:2010.0000).

	Xr(m)	Yr(m)	Zr(m)	
P049	-1545098.96258	-4044897.09076	4669084.58571	2010.00
P052	-1266647.47009	-4138195.80517	4670709.51765	2010.00
MTLW	-1449332.61170	-4105831.06162	4646773.52520	2010.00

Velocity of reference station monument in NAD_83(2011)(EPOCH:2010.0000).

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
P049	-0.01570	-0.00020	-0.00670
P052	-0.01580	0.00030	-0.00570
MTLW	-0.01600	-0.00030	-0.00530

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)	
P049	-176503.28858	7764.60424	-47723.06029	2010.00

P052 101948.20391 -85534.11017 -46098.12835 2010.00
MTLW -80736.93770 -53169.36662 -70034.12080 2010.00

STATE PLANE COORDINATES - International Foot

SPC (2500 MT)

Northing (Y) [feet] 1363689.357
Easting (X) [feet] 2174120.663
Convergence [degrees] 0.61448146
Point Scale 0.99953779
Combined Factor 0.99935757

** 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: 1164.901 (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.