

OPUS solution : 018772_14_223_A3.14O OP1408133666659

opus <opus@ngs.noaa.gov>

Fri 8/15/2014 2:16 PM

To:John Freetly <John.Freetly@neciusa.com>;

FILE: 018772_14_223_A3.14O OP1408133666659

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: john.freetly@neciusa.com DATE: August 15, 2014
 RINEX FILE: 0187223x.14o TIME: 20:16:32 UTC

SOFTWARE: page5 1209.04 master91.pl 022814 START: 2014/08/11 23:10:00
 EPHEMERIS: igr18051.eph [rapid] STOP: 2014/08/12 02:09:00
 NAV FILE: brdc2230.14n OBS USED: 6426 / 6702 : 96%
 ANT NAME: CHCX90D-OPUS NONE # FIXED AMB: 44 / 47 : 94%
 ARP HEIGHT: 1.8000 OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2014.6110)

X: -1394155.457(m) 0.003(m) -1394156.332(m) 0.003(m)
 Y: -4035028.810(m) 0.008(m) -4035027.587(m) 0.008(m)
 Z: 4724163.279(m) 0.014(m) 4724163.270(m) 0.014(m)

LAT: 48 5 17.29265 0.004(m) 48 5 17.31342 0.004(m)
 E LON: 250 56 21.46730 0.004(m) 250 56 21.40805 0.004(m)
 W LON: 109 3 38.53270 0.004(m) 109 3 38.59195 0.004(m)
 EL HGT: 987.736(m) 0.016(m) 987.148(m) 0.016(m)
 ORTHO HGT: 1002.878(m) 0.028(m) [NAVD88 (Computed using GEOID12A)]

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 12) SPC (2500 MT)

Northing (Y) [meters] 5327915.424 426583.326
 Easting (X) [meters] 644413.287 632712.513
 Convergence [degrees] 1.44342072 0.32134722
 Point Scale 0.99985626 0.99956939
 Combined Factor 0.99970150 0.99941467

US NATIONAL GRID DESIGNATOR: 12UXU4441327915(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DL7731	P053 WHITEWATERMT2007	CORS ARP	N484333.865 W1074331.456	121690.5
DI3425	P052 LRRNCHJRDNMT2006	CORS ARP	N472229.026 W1070107.185	172508.0
DI2257	P049 ARMINGTON_MT2006	CORS ARP	N472059.850 W1105422.382	160981.3

NEAREST NGS PUBLISHED CONTROL POINT

TK0473	CEDAR	N480445.322	W1090636.805	3813.0
--------	-------	-------------	--------------	--------

BASE STATION INFORMATION

STATION NAME: p053 a 1 (WhitewaterMT2007; Whitewater, Montana USA)

MONUMENT: NO DOMES NUMBER

XYZ	-1283559.0999	-4015770.3187	4771131.6503	MON @ 2005.0000 (M)
XYZ	-0.0164	-0.0004	-0.0047	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	0.1184	ARP TO L2 PHASE CENTER (M)
XYZ	-0.1578	-0.0037	-0.0453	VEL TIMES 9.6101 YRS
XYZ	-0.0017	-0.0052	0.0062	MON TO ARP
XYZ	-0.0163	-0.0534	0.0654	ARP TO L1 PHASE CENTER
XYZ	-1283559.2756	-4015770.3811	4771131.6766	L1 PHS CEN @ 2014.6110
XYZ	0.0000	-0.0000	-0.0000	+ XYZ ADJUSTMENTS
XYZ	-1283559.2756	-4015770.3811	4771131.6766	NEW L1 PHS CEN @ 2014.6110
XYZ	-1283559.2593	-4015770.3277	4771131.6112	NEW ARP @ 2014.6110
XYZ	-1283559.2576	-4015770.3225	4771131.6050	NEW MON @ 2014.6110
LLH	48 43 33.88708	252 16 28.48429	815.0921	NEW L1 PHS CEN @ 2014.6110
LLH	48 43 33.88705	252 16 28.48425	815.0061	NEW ARP @ 2014.6110
LLH	48 43 33.88705	252 16 28.48425	814.9978	NEW MON @ 2014.6110

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	-0.1519	0.0031	-0.0551	VEL TIMES 9.6101 YRS
XYZ	-0.0016	-0.0054	0.0061	MON TO ARP
XYZ	-0.0161	-0.0551	0.0641	ARP TO L1 PHASE CENTER
XYZ	-1266648.3543	-4138194.6249	4670709.5635	L1 PHS CEN @ 2014.6110
XYZ	0.0000	-0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	-1266648.3543	-4138194.6249	4670709.5635	NEW L1 PHS CEN @ 2014.6110
XYZ	-1266648.3382	-4138194.5698	4670709.4995	NEW ARP @ 2014.6110
XYZ	-1266648.3366	-4138194.5645	4670709.4934	NEW MON @ 2014.6110
LLH	47 22 29.04864	252 58 52.75788	858.7208	NEW L1 PHS CEN @ 2014.6110

LLH 47 22 29.04860 252 58 52.75784 858.6348 NEW ARP @ 2014.6110
 LLH 47 22 29.04860 252 58 52.75784 858.6265 NEW MON @ 2014.6110

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 0.1184 ARP TO L2 PHASE CENTER (M)
 XYZ -0.1513 -0.0017 -0.0646 VEL TIMES 9.6101 YRS
 XYZ -0.0020 -0.0053 0.0061 MON TO ARP
 XYZ -0.0198 -0.0539 0.0640 ARP TO L1 PHASE CENTER
 XYZ -1545099.8553 -4044895.9261 4669084.6385 L1 PHS CEN @ 2014.6110
 XYZ 0.0000 0.0000 0.0000 + XYZ ADJUSTMENTS
 XYZ -1545099.8553 -4044895.9261 4669084.6385 NEW L1 PHS CEN @ 2014.6110
 XYZ -1545099.8355 -4044895.8722 4669084.5744 NEW ARP @ 2014.6110
 XYZ -1545099.8335 -4044895.8669 4669084.5683 NEW MON @ 2014.6110
 LLH 47 20 59.87006 249 5 37.55749 1186.1535 NEW L1 PHS CEN @ 2014.6110
 LLH 47 20 59.87002 249 5 37.55746 1186.0675 NEW ARP @ 2014.6110
 LLH 47 20 59.87002 249 5 37.55746 1186.0592 NEW MON @ 2014.6110

REMOTE STATION INFORMATION

STATION NAME: 0187 1

MONUMENT: NO DOMES NUMBER

XYZ -1394156.1109 -4035027.9333 4724162.9159 MON @ 2014.6109 (M)
 NEU -0.0011 0.0007 1.8000 MON TO ARP (M)
 NEU 0.0011 -0.0007 0.0892 ARP TO L1 PHASE CENTER (M)
 NEU 0.0007 -0.0031 0.1016 ARP TO L2 PHASE CENTER (M)
 XYZ -0.3923 -1.1375 1.3388 MON TO ARP
 XYZ -0.0198 -0.0554 0.0671 ARP TO L1 PHASE CENTER
 XYZ -1394156.5230 -4035029.1261 4724164.3219 L1 PHS CEN @ 2014.6110

BASELINE NAME: p053 0187

XYZ -0.2228 0.3445 0.3570 + XYZ ADJUSTMENTS
 XYZ -1394156.7458 -4035028.7817 4724164.6788 NEW L1 PHS CEN @ 2014.6110
 XYZ -1394156.7260 -4035028.7263 4724164.6117 NEW ARP @ 2014.6110
 XYZ -1394156.3337 -4035027.5888 4724163.2729 NEW MON @ 2014.6110
 LLH 48 5 17.31343 250 56 21.40800 989.0405 NEW L1 PHS CEN @ 2014.6110
 LLH 48 5 17.31339 250 56 21.40803 988.9512 NEW ARP @ 2014.6110
 LLH 48 5 17.31343 250 56 21.40800 987.1512 NEW MON @ 2014.6110

BASELINE NAME: p052 0187

XYZ -0.2198 0.3423 0.3603 + XYZ ADJUSTMENTS
 XYZ -1394156.7428 -4035028.7838 4724164.6822 NEW L1 PHS CEN @ 2014.6110
 XYZ -1394156.7230 -4035028.7284 4724164.6150 NEW ARP @ 2014.6110
 XYZ -1394156.3307 -4035027.5910 4724163.2762 NEW MON @ 2014.6110
 LLH 48 5 17.31348 250 56 21.40817 989.0437 NEW L1 PHS CEN @ 2014.6110
 LLH 48 5 17.31344 250 56 21.40820 988.9544 NEW ARP @ 2014.6110
 LLH 48 5 17.31348 250 56 21.40817 987.1544 NEW MON @ 2014.6110

BASELINE NAME: p049 0187
 XYZ -0.2205 0.3508 0.3459 + XYZ ADJUSTMENTS
 XYZ -1394156.7436 -4035028.7754 4724164.6678 NEW L1 PHS CEN @ 2014.6110
 XYZ -1394156.7237 -4035028.7200 4724164.6006 NEW ARP @ 2014.6110
 XYZ -1394156.3314 -4035027.5825 4724163.2618 NEW MON @ 2014.6110
 LLH 48 5 17.31335 250 56 21.40800 989.0278 NEW L1 PHS CEN @ 2014.6110
 LLH 48 5 17.31331 250 56 21.40804 988.9385 NEW ARP @ 2014.6110
 LLH 48 5 17.31335 250 56 21.40800 987.1385 NEW MON @ 2014.6110

G-FILES

Axx2014 811 14 812
 B2014 8112310 14 812 2 9 1 page5 v1209.04IGS 126 1 2 27NGS 2014 815IFDDPX
 IIGS08_1804 IGS 20140803
 C00090004 1105970761 8 192572663 20 469683321 21 X2234A0187X2234AP053
 D 1 2 7207982 1 3 -6577890 2 3 -9183117

Axx2014 811 14 812
 B2014 8112310 14 812 2 9 1 page5 v1209.04IGS 126 1 2 27NGS 2014 815IFDDPX
 IIGS08_1804 IGS 20140803
 C00090005 1275079942 6-1031669735 19 -534537828 19 X2234A0187X2234AP052
 D 1 2 5625852 1 3 -7521828 2 3 -8988197

Axx2014 811 14 812
 B2014 8112310 14 812 2 9 1 page5 v1209.04IGS 126 1 2 27NGS 2014 815IFDDPX
 IIGS08_1804 IGS 20140803
 C00090001-1509435021 7 -98682844 17 -550786935 17 X2234A0187X2234AP049
 D 1 2 7390939 1 3 -6958245 2 3 -9212599

POST-FIT RMS BY SATELLITE VS. BASELINE

OVERALL 02 05 06 10 12 15 16 18
 p053-0187| 0.012 0.011 0.007 0.019 0.012 0.011 0.014 0.017 0.011
 21 25 26 29 31
 p053-0187| 0.011 0.012 0.014 ... 0.018

OVERALL 02 05 06 10 12 15 16 18
 p052-0187| 0.011 0.010 0.007 0.015 0.012 0.011 0.012 0.014 0.011
 21 25 26 29 31
 p052-0187| 0.011 0.010 0.013 ... 0.022

OVERALL 02 05 06 10 12 15 16 18
 p049-0187| 0.011 0.010 0.006 0.012 0.010 0.012 0.010 0.015 0.012
 21 25 26 29 31
 p049-0187| 0.009 0.009 0.013 ... 0.022

OBS BY SATELLITE VS. BASELINE

OVERALL 02 05 06 10 12 15 16 18
 p053-0187| 2071 256 356 66 157 146 133 107 118

```

    21  25  26  29  31
p053-0187| 225 260 201 ... 46
    OVERALL 02 05 06 10 12 15 16 18
p052-0187| 2156 264 356 67 170 166 148 108 119
    21  25  26  29  31
p052-0187| 258 248 201 ... 51
    OVERALL 02 05 06 10 12 15 16 18
p049-0187| 2199 256 356 59 174 166 142 118 126
    21  25  26  29  31
p049-0187| 269 263 198 ... 72
    
```

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

```

0.0000007889  0.0000001475  -0.0000001821
0.0000001475  0.0000049644  -0.0000004769
-0.0000001821 -0.0000004769  0.0000062533
    
```

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

```

0.0000011431  -0.0000008811  0.0000007742
-0.0000008811  0.0000048412  0.0000007659
0.0000007742  0.0000007659  0.0000060223
    
```

Horizontal network accuracy = 0.00452 meters.

Vertical network accuracy = 0.00481 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)
P053 -1283558.38336 -4015771.55123 4771131.61488 2010.00
P052 -1266647.47169 -4138195.81057 4670709.52375 2010.00
P049 -1545098.96458 -4044897.09606 4669084.59181 2010.00
    
```

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

```

    Xr(m)    Yr(m)    Zr(m)
P053 -1283558.38166 -4015771.54603 4771131.60868 2010.00
P052 -1266647.47009 -4138195.80517 4670709.51765 2010.00
P049 -1545098.96258 -4044897.09076 4669084.58571 2010.00
    
```

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

```

    Vx (m/yr)  Vy (m/yr)  Vz (m/yr)
P053  -0.01640  -0.00040  -0.00470
P052  -0.01580   0.00030  -0.00570
P049  -0.01570  -0.00020  -0.00670
    
```

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)
P053  110597.07534  19257.26397  46968.32968 2010.00
    
```

P052 127507.98691 -103166.99517 -53453.76135 2010.00
P049 -150943.50558 -9868.28076 -55078.69329 2010.00

STATE PLANE COORDINATES - International Foot

SPC (2500 MT)

Northing (Y) [feet] 1399551.594
Easting (X) [feet] 2075828.455
Convergence [degrees] 0.32134722
Point Scale 0.99956939
Combined Factor 0.99941467

** 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: 1001.877 (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.