

OPUS-RS solution : 401289226U.14O OP1408550214973

opus <opus@ngs.noaa.gov>

Wed 8/20/2014 9:59 AM

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

FILE: 401289226U.14O OP1408550214973

NGS OPUS-RS SOLUTION REPORT =====

All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: cmozol@neciusa.com DATE: August 20, 2014
RINEX FILE: 4012226u.14o TIME: 15:59:29 UTC

SOFTWARE: rsgps 1.37 RS51.pr1 1.99.2 START: 2014/08/14 20:28:20
EPHEMERIS: igr18054.eph [rapid] STOP: 2014/08/14 21:11:15
NAV FILE: brdc2260.14n OBS USED: 1920 / 2140 : 90%
ANT NAME: CHCX91R NONE QUALITY IND. 7.46/ 38.07
ARP HEIGHT: 1.8 NORMALIZED RMS: 0.407

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2014.61882)

X:	-1387580.041(m)	0.014(m)	-1387580.917(m)	0.014(m)
Y:	-4030791.543(m)	0.018(m)	-4030790.320(m)	0.018(m)
Z:	4729731.871(m)	0.020(m)	4729731.863(m)	0.020(m)

LAT:	48 9 45.84470	0.007(m)	48 9 45.86554	0.007(m)
E LON:	251 0 15.22499	0.009(m)	251 0 15.16565	0.009(m)
W LON:	108 59 44.77501	0.009(m)	108 59 44.83435	0.009(m)
EL HGT:	1029.319(m)	0.028(m)	1028.732(m)	0.028(m)
ORTHO HGT:	1044.557(m)	0.030(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 12)	SPC (2500 MT)
Northing (Y) [meters]	5336330.169	434903.544
Easting (X) [meters]	649032.374	637494.333
Convergence [degrees]	1.49350900	0.36884575
Point Scale	0.99987291	0.99959486
Combined Factor	0.99971163	0.99943363

US NATIONAL GRID DESIGNATOR: 12UXU4903236330(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DG9749	MTMS MONTANA STATE UNI	CORS ARP	N483227.426 W1094111.858	66270.7
DL7731	P053 WHITEWATERMT2007	CORS ARP	N484333.865 W1074331.456	112960.4
DI2257	P049 ARMINGTON_MT2006	CORS ARP	N472059.850 W1105422.382	169379.1
DI3425	P052 LRRNCHJRDNMT2006	CORS ARP	N472229.026 W1070107.185	172174.3

NEAREST NGS PUBLISHED CONTROL POINT

Information on nearest mark is not available due to database connectivity issues or has restrictions on when or how it can be published.

OPUS-RS Extended Output, Level 2

FINAL COORDINATES (ITRF at epoch of observations)

mtms	-1425435.562	-3984013.184	4757493.846
p053	-1283559.267	-4015770.329	4771131.608
p049	-1545099.854	-4044895.897	4669084.599
p052	-1266648.331	-4138194.564	4670709.498
4012	-1387580.917	-4030790.320	4729731.863

Covariance matrix of the stations:

1	7.2800E-07	1.3990E-06	-1.6660E-06	-1.6950E-07	-4.2640E-07	4.6830E-07	-8.8050E-08	-4.7550E-07	5.6140E-07
	-2.2040E-07	-4.9730E-07	6.3690E-07	-2.0530E-08	-2.0410E-07	2.3030E-07			
2	1.3990E-06	3.4300E-06	-3.8570E-06	-4.7770E-07	-1.0300E-06	1.2110E-06	-3.9980E-07	-1.0710E-06	1.2920E-06
	-5.2090E-07	-1.0790E-06	1.3540E-06	-1.1480E-07	-1.8870E-07	2.9750E-07			
3	-1.6660E-06	-3.8570E-06	4.7550E-06	6.0570E-07	1.2770E-06	-1.4090E-06	3.6740E-07	1.2040E-06	-1.3990E-06
	6.9290E-07	1.3750E-06	-1.6980E-06	1.9150E-07	4.4550E-07	-4.4460E-07			
4	-1.6950E-07	-4.7770E-07	6.0570E-07	5.7110E-07	1.0900E-06	-1.2220E-06	-2.5640E-07	-5.3510E-07	5.9290E-07
	1.0410E-07	-7.6460E-08	2.2990E-08	1.5330E-07	2.0030E-07	-2.1060E-07			
5	-4.2640E-07	-1.0300E-06	1.2770E-06	1.0900E-06	2.9760E-06	-3.2340E-06	-5.1370E-07	-1.0920E-06	1.2750E-06
	-1.5190E-07	-6.0400E-07	6.8050E-07	7.6910E-08	1.7600E-07	-1.0540E-07			
6	4.6830E-07	1.2110E-06	-1.4090E-06	-1.2220E-06	-3.2340E-06	3.9060E-06	5.2570E-07	1.2420E-06	-1.3930E-06
	2.3130E-07	7.8150E-07	-8.5330E-07	-4.6920E-08	-2.2810E-08	6.5980E-08			
7	-8.8050E-08	-3.9980E-07	3.6740E-07	-2.5640E-07	-5.1370E-07	5.2570E-07	9.5250E-07	1.5790E-06	-1.7500E-06
	-3.5710E-07	-6.6650E-07	8.5890E-07	-1.3240E-07	-4.3860E-07	4.7130E-07			
8	-4.7550E-07	-1.0710E-06	1.2040E-06	-5.3510E-07	-1.0920E-06	1.2420E-06	1.5790E-06	3.5270E-06	-3.7890E-06
	-5.6490E-07	-1.1150E-06	1.3430E-06	-2.1320E-07	-3.3820E-07	4.2720E-07			
9	5.6140E-07	1.2920E-06	-1.3990E-06	5.9290E-07	1.2750E-06	-1.3930E-06	-1.7500E-06	-3.7890E-06	4.4360E-06
	5.9200E-07	1.2210E-06	-1.3940E-06	2.1910E-07	3.9870E-07	-3.6070E-07			
10	-2.2040E-07	-5.2090E-07	6.9290E-07	1.0410E-07	-1.5190E-07	2.3130E-07	-3.5710E-07	-5.6490E-07	5.9200E-07
	7.2290E-07	1.2380E-06	-1.5170E-06	2.4970E-07	4.4280E-07	-4.9130E-07			
11	-4.9730E-07	-1.0790E-06	1.3750E-06	-7.6460E-08	-6.0400E-07	7.8150E-07	-6.6650E-07	-1.1150E-06	1.2210E-06
	1.2380E-06	3.0470E-06	-3.3770E-06	2.5130E-07	6.0180E-07	-6.2000E-07			
12	6.3690E-07	1.3540E-06	-1.6980E-06	2.2990E-08	6.8050E-07	-8.5330E-07	8.5890E-07	1.3430E-06	-1.3940E-06
	-1.5170E-06	-3.3770E-06	4.1960E-06	-3.6390E-07	-8.2240E-07	9.9010E-07			
13	-2.0530E-08	-1.1480E-07	1.9150E-07	1.5330E-07	7.6910E-08	-4.6920E-08	-1.3240E-07	-2.1320E-07	2.1910E-07
	2.4970E-07	2.5130E-07	-3.6390E-07	6.9140E-06	1.5420E-05	-1.7510E-05			
14	-2.0410E-07	-1.8870E-07	4.4550E-07	2.0030E-07	1.7600E-07	-2.2810E-08	-4.3860E-07	-3.3820E-07	3.9870E-07

4.4280E-07 6.0180E-07 -8.2240E-07 1.5420E-05 3.9860E-05 -4.3910E-05
 15 2.3030E-07 2.9750E-07 -4.4460E-07 -2.1060E-07 -1.0540E-07 6.5980E-08 4.7130E-07 4.2720E-07 -3.6070E-07
 -4.9130E-07 -6.2000E-07 9.9010E-07 -1.7510E-05 -4.3910E-05 5.1650E-05

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

0.0000069140 0.0000154200 -0.0000175100
 0.0000154200 0.0000398600 -0.0000439100
 -0.0000175100 -0.0000439100 0.0000516500

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

0.0000009129 -0.0000000206 -0.0000030290
 -0.0000000206 0.0000014914 -0.0000020100
 -0.0000030290 -0.0000020100 0.0000960197

Horizontal network accuracy = 0.00270 meters.

Vertical network accuracy = 0.01921 meters.

		Vectors		
To	From	X	Y	Z
mtms	4012	-37854.646	46777.135	27761.983
p053	4012	104021.650	15019.990	41399.745
p049	4012	-157518.937	-14105.577	-60647.264
p052	4012	120932.586	-107404.244	-59022.365

Covariance matrix of the 4 vectors

1 7.6831E-06 1.7138E-05 -1.9598E-05 6.6117E-06 1.5121E-05 -1.7225E-05 6.9789E-06 1.5362E-05 -1.7398E-05
 6.4644E-06 1.4876E-05 -1.6740E-05
 2 1.7138E-05 4.3667E-05 -4.8510E-05 1.4857E-05 3.8843E-05 -4.2974E-05 1.5574E-05 3.9316E-05 -4.3314E-05
 1.4571E-05 3.8368E-05 -4.2031E-05
 3 -1.9598E-05 -4.8510E-05 5.7294E-05 -1.6885E-05 -4.2973E-05 5.0620E-05 -1.7805E-05 -4.3579E-05 5.1056E-05
 -1.6517E-05 -4.2360E-05 4.9407E-05
 4 6.6117E-06 1.4857E-05 -1.6885E-05 7.1785E-06 1.6233E-05 -1.8474E-05 6.6367E-06 1.4898E-05 -1.6926E-05
 6.6151E-06 1.4892E-05 -1.6913E-05
 5 1.5121E-05 3.8843E-05 -4.2973E-05 1.6233E-05 4.2484E-05 -4.7016E-05 1.5268E-05 3.8930E-05 -4.2928E-05
 1.4748E-05 3.8478E-05 -4.2302E-05
 6 -1.7225E-05 -4.2974E-05 5.0620E-05 -1.8474E-05 -4.7016E-05 5.5424E-05 -1.7409E-05 -4.3072E-05 5.0552E-05
 -1.6740E-05 -4.2486E-05 4.9741E-05
 7 6.9789E-06 1.5574E-05 -1.7805E-05 6.6367E-06 1.5268E-05 -1.7409E-05 8.1313E-06 1.7651E-05 -1.9950E-05
 6.4396E-06 1.4941E-05 -1.6758E-05
 8 1.5362E-05 3.9316E-05 -4.3579E-05 1.4898E-05 3.8930E-05 -4.3072E-05 1.7651E-05 4.4063E-05 -4.8525E-05
 1.4626E-05 3.8481E-05 -4.2172E-05
 9 -1.7398E-05 -4.3314E-05 5.1056E-05 -1.6926E-05 -4.2928E-05 5.0552E-05 -1.9950E-05 -4.8525E-05 5.6807E-05
 -1.6646E-05 -4.2468E-05 4.9627E-05
 10 6.4644E-06 1.4571E-05 -1.6517E-05 6.6151E-06 1.4748E-05 -1.6740E-05 6.4396E-06 1.4626E-05 -1.6646E-05
 7.1375E-06 1.5964E-05 -1.8172E-05
 11 1.4876E-05 3.8368E-05 -4.2360E-05 1.4892E-05 3.8478E-05 -4.2486E-05 1.4941E-05 3.8481E-05 -4.2468E-05
 1.5964E-05 4.1703E-05 -4.5845E-05
 12 -1.6740E-05 -4.2031E-05 4.9407E-05 -1.6913E-05 -4.2302E-05 4.9741E-05 -1.6758E-05 -4.2172E-05 4.9627E-05
 -1.8172E-05 -4.5845E-05 5.3866E-05

Correlation matrix of the 4 vectors

1 1.0000E+00 9.3565E-01 -9.3408E-01 8.9029E-01 8.3694E-01 -8.3473E-01 8.8296E-01 8.3490E-01 -8.3278E-01

8.7295E-01 8.3103E-01 -8.2285E-01
 2 9.3565E-01 1.0000E+00 -9.6983E-01 8.3913E-01 9.0182E-01 -8.7352E-01 8.2648E-01 8.9629E-01 -8.6966E-01
 8.2535E-01 8.9909E-01 -8.6663E-01
 3 -9.3408E-01 -9.6983E-01 1.0000E+00 -8.3260E-01 -8.7102E-01 8.9829E-01 -8.2493E-01 -8.6732E-01 8.9494E-01
 -8.1679E-01 -8.6660E-01 8.8935E-01
 4 8.9029E-01 8.3913E-01 -8.3260E-01 1.0000E+00 9.2953E-01 -9.2620E-01 8.6867E-01 8.3766E-01 -8.3816E-01
 9.2416E-01 8.6069E-01 -8.6007E-01
 5 8.3694E-01 9.0182E-01 -8.7102E-01 9.2953E-01 1.0000E+00 -9.6891E-01 8.2147E-01 8.9978E-01 -8.7383E-01
 8.4695E-01 9.1415E-01 -8.8428E-01
 6 -8.3473E-01 -8.7352E-01 8.9829E-01 -9.2620E-01 -9.6891E-01 1.0000E+00 -8.2004E-01 -8.7159E-01 9.0092E-01
 -8.4168E-01 -8.8371E-01 9.1034E-01
 7 8.8296E-01 8.2648E-01 -8.2493E-01 8.6867E-01 8.2147E-01 -8.2004E-01 1.0000E+00 9.3249E-01 -9.2826E-01
 8.4529E-01 8.1135E-01 -8.0075E-01
 8 8.3490E-01 8.9629E-01 -8.6732E-01 8.3766E-01 8.9978E-01 -8.7159E-01 9.3249E-01 1.0000E+00 -9.6989E-01
 8.2471E-01 8.9769E-01 -8.6562E-01
 9 -8.3278E-01 -8.6966E-01 8.9494E-01 -8.3816E-01 -8.7383E-01 9.0092E-01 -9.2826E-01 -9.6989E-01 1.0000E+00
 -8.2666E-01 -8.7251E-01 8.9713E-01
 10 8.7295E-01 8.2535E-01 -8.1679E-01 9.2416E-01 8.4695E-01 -8.4168E-01 8.4529E-01 8.2471E-01 -8.2666E-01
 1.0000E+00 9.2529E-01 -9.2676E-01
 11 8.3103E-01 8.9909E-01 -8.6660E-01 8.6069E-01 9.1415E-01 -8.8371E-01 8.1135E-01 8.9769E-01 -8.7251E-01
 9.2529E-01 1.0000E+00 -9.6727E-01
 12 -8.2285E-01 -8.6663E-01 8.8935E-01 -8.6007E-01 -8.8428E-01 9.1034E-01 -8.0075E-01 -8.6562E-01 8.9713E-01
 -9.2676E-01 -9.6727E-01 1.0000E+00

G-FILE for the vectors

Axx2014 8142014 814
 B201408142000201408142100 4 rsgps 1.37IGS
 lant_info.003 NGS
 C00050001 -378546457 27 467771351 66 277619827 75
 C00050002 1040216500 26 150199904 65 413997454 74
 C00050003 -1575189370 28 -141055774 66 -606472637 75
 C00050004 1209325855 26 -1074042442 64 -590223648 73
 D 1 2 9356465 1 3 -9340817 1 4 8902892 1 5 8369406 1 6 -8347281
 D 1 7 8829551 1 8 8349029 1 9 -8327789 1 10 8729513 1 11 8310338
 D 1 12 -8228464 2 3 -9698337 2 4 8391309 2 5 9018162 2 6 -8735240
 D 2 7 8264762 2 8 8962941 2 9 -8696593 2 10 8253546 2 11 8990909
 D 2 12 -8666336 3 4 -8325954 3 5 -8710210 3 6 8982856 3 7 -8249286
 D 3 8 -8673211 3 9 8949351 3 10 -8167904 3 11 -8666026 3 12 8893489
 D 4 5 9295304 4 6 -9262032 4 7 8686710 4 8 8376571 4 9 -8381558
 D 4 10 9241585 4 11 8606938 4 12 -8600716 5 6 -9689066 5 7 8214652
 D 5 8 8997770 5 9 -8738331 5 10 8469521 5 11 9141475 5 12 -8842774
 D 6 7 -8200432 6 8 -8715872 6 9 9009161 6 10 -8416775 6 11 -8837061
 D 6 12 9103440 7 8 9324926 7 9 -9282589 7 10 8452902 7 11 8113497
 D 7 12 -8007530 8 9 -9698915 8 10 8247050 8 11 8976894 8 12 -8656185
 D 9 10 -8266642 9 11 -8725102 9 12 8971302 10 11 9252949 10 12 -9267622
 D 11 12 -9672659

ITRF position of 4012 as determined by individual baselines

	X	Y	Z
mtms	-1387580.934	-4030790.340	4729731.890
p053	-1387580.911	-4030790.328	4729731.879

p049 -1387580.905 -4030790.304 4729731.850
 p052 -1387580.928 -4030790.335 4729731.868

Residuals of position determined by individual baselines from the final position

	X	Y	Z	East	North	Up
mtms	-0.017	-0.021	0.027	-0.009	-0.000	0.037
p053	0.006	-0.009	0.016	0.009	0.006	0.016
p049	0.012	0.016	-0.013	0.006	0.005	-0.022
p052	-0.012	-0.015	0.005	-0.006	-0.010	0.016

STATE PLANE COORDINATES - International Foot

SPC (2500 MT)

Northing (Y) [feet] 1426848.898
 Easting (X) [feet] 2091516.841
 Convergence [degrees] 0.36884575
 Point Scale 0.99959486
 Combined Factor 0.99943363

** 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: 1043.558 (m) [PROTOTYPE (Computed using USGG2012,GRS80,IGS08)]

dop from interpolation is 0.505
 scatter (mean square distance from rover) is 18360.079
 average edop for rover is 0.650
 average ndop for rover is 0.890
 average hdop for rover is 1.102
 average vdop for rover is 1.920
 average gdop for rover is 2.570

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.