

OPUS solution : 018506_14_232_A0.14O OP1408630554803

opus <opus@ngs.noaa.gov>

Thu 8/21/2014 8:18 AM

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

FILE: 018506_14_232_A0.14O OP1408630554803

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: cmozol@neciusa.com DATE: August 21, 2014
RINEX FILE: 0185232t.14o TIME: 14:18:11 UTC

SOFTWARE: page5 1209.04 master53.pl 022814 START: 2014/08/20 19:01:00
EPHEMERIS: igu18063.eph [ultra-rapid] STOP: 2014/08/20 22:08:00
NAV FILE: brdc2320.14n OBS USED: 6793 / 7533 : 90%
ANT NAME: CHCX90D-OPUS NONE # FIXED AMB: 58 / 60 : 97%
ARP HEIGHT: 1.8 OVERALL RMS: 0.015(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2014.6352)

X: -1340979.309(m) 0.004(m) -1340980.184(m) 0.004(m)
Y: -4049053.594(m) 0.004(m) -4049052.368(m) 0.004(m)
Z: 4727289.394(m) 0.010(m) 4727289.384(m) 0.010(m)

LAT: 48 7 55.40783 0.002(m) 48 7 55.42904 0.002(m)
E LON: 251 40 33.55259 0.002(m) 251 40 33.49378 0.002(m)
W LON: 108 19 26.44741 0.002(m) 108 19 26.50622 0.002(m)
EL HGT: 806.150(m) 0.011(m) 805.549(m) 0.011(m)
ORTHO HGT: 822.494(m) 0.021(m) [NAVD88 (Computed using GEOID12A)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 12) SPC (2500 MT)
Northing (Y) [meters] 5334441.621 432030.029
Easting (X) [meters] 699098.786 687494.545
Convergence [degrees] 1.99341885 0.86023931
Point Scale 1.00008709 0.99958418
Combined Factor 0.99996075 0.99945790

US NATIONAL GRID DESIGNATOR: 12UXU9909834441(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DG9749	MTMS MONTANA STATE UNI	CORS ARP	N483227.426 W1094111.858	110793.1
DL7731	P053 WHITEWATERMT2007	CORS ARP	N484333.865 W1074331.456	79542.4
DI3425	P052 LRRNCHJRDNMT2006	CORS ARP	N472229.026 W1070107.185	129123.3

NEAREST NGS PUBLISHED CONTROL POINT

TK0049	T 275	N480721.	W1081659.	3223.9
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BASE STATION INFORMATION

STATION NAME: mtms a 1 (MONTANA STATE UNIVERSI; Havre, Montana, U.S.A.)

MONUMENT: NO DOMES NUMBER

XYZ	-1425435.4171	-3984013.1973	4757493.9413	MON @ 2005.0000 (M)
XYZ	-0.0165	-0.0009	-0.0066	VEL (M/YR)
NEU	0.0000	0.0000	0.0000	MON TO ARP (M)
NEU	0.0003	0.0005	0.0559	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	0.0005	0.0580	ARP TO L2 PHASE CENTER (M)
XYZ	-0.1586	-0.0083	-0.0637	VEL TIMES 9.6343 YRS
XYZ	0.0000	0.0000	0.0000	MON TO ARP
XYZ	-0.0119	-0.0348	0.0421	ARP TO L1 PHASE CENTER
XYZ	-1425435.5876	-3984013.2404	4757493.9197	L1 PHS CEN @ 2014.6352
XYZ	-0.0000	0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	-1425435.5876	-3984013.2404	4757493.9197	NEW L1 PHS CEN @ 2014.6352
XYZ	-1425435.5756	-3984013.2056	4757493.8776	NEW ARP @ 2014.6352
XYZ	-1425435.5756	-3984013.2056	4757493.8776	NEW MON @ 2014.6352
LLH	48 32 27.44704	250 18 48.08172	773.4071	NEW L1 PHS CEN @ 2014.6352
LLH	48 32 27.44704	250 18 48.08169	773.3512	NEW ARP @ 2014.6352
LLH	48 32 27.44704	250 18 48.08169	773.3512	NEW MON @ 2014.6352

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	-0.1582	-0.0038	-0.0454	VEL TIMES 9.6343 YRS
XYZ	-0.0017	-0.0052	0.0062	MON TO ARP
XYZ	-0.0163	-0.0534	0.0654	ARP TO L1 PHASE CENTER
XYZ	-1283559.2760	-4015770.3811	4771131.6765	L1 PHS CEN @ 2014.6352
XYZ	0.0000	0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	-1283559.2760	-4015770.3811	4771131.6765	NEW L1 PHS CEN @ 2014.6352
XYZ	-1283559.2597	-4015770.3277	4771131.6111	NEW ARP @ 2014.6352
XYZ	-1283559.2580	-4015770.3225	4771131.6049	NEW MON @ 2014.6352
LLH	48 43 33.88708	252 16 28.48427	815.0921	NEW L1 PHS CEN @ 2014.6352

LLH 48 43 33.88704 252 16 28.48424 815.0061 NEW ARP @ 2014.6352
 LLH 48 43 33.88704 252 16 28.48424 814.9978 NEW MON @ 2014.6352

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 -0.1523 0.0032 -0.0552 VEL TIMES 9.6343 YRS
 XYZ -0.0016 -0.0054 0.0061 MON TO ARP
 XYZ -0.0161 -0.0551 0.0641 ARP TO L1 PHASE CENTER
 XYZ -1266648.3547 -4138194.6249 4670709.5634 L1 PHS CEN @ 2014.6352
 XYZ 0.0000 -0.0000 -0.0000 + XYZ ADJUSTMENTS
 XYZ -1266648.3547 -4138194.6249 4670709.5634 NEW L1 PHS CEN @ 2014.6352
 XYZ -1266648.3386 -4138194.5698 4670709.4993 NEW ARP @ 2014.6352
 XYZ -1266648.3369 -4138194.5645 4670709.4932 NEW MON @ 2014.6352
 LLH 47 22 29.04863 252 58 52.75786 858.7208 NEW L1 PHS CEN @ 2014.6352
 LLH 47 22 29.04859 252 58 52.75782 858.6348 NEW ARP @ 2014.6352
 LLH 47 22 29.04859 252 58 52.75782 858.6265 NEW MON @ 2014.6352

REMOTE STATION INFORMATION

STATION NAME: 0185 1
 MONUMENT: NO DOMES NUMBER
 XYZ -1340980.6362 -4049052.5063 4727289.3823 MON @ 2014.6350 (M)
 NEU -0.0011 0.0007 1.8001 MON TO ARP (M)
 NEU 0.0011 -0.0007 0.0892 ARP TO L1 PHASE CENTER (M)
 NEU 0.0007 -0.0031 0.1017 ARP TO L2 PHASE CENTER (M)
 XYZ -0.3773 -1.1414 1.3397 MON TO ARP
 XYZ -0.0191 -0.0556 0.0672 ARP TO L1 PHASE CENTER
 XYZ -1340981.0326 -4049053.7033 4727290.7892 L1 PHS CEN @ 2014.6352

BASELINE NAME: mtms 0185
 XYZ 0.4497 0.1354 0.0069 + XYZ ADJUSTMENTS
 XYZ -1340980.5829 -4049053.5679 4727290.7962 NEW L1 PHS CEN @ 2014.6352
 XYZ -1340980.5638 -4049053.5123 4727290.7290 NEW ARP @ 2014.6352
 XYZ -1340980.1865 -4049052.3709 4727289.3892 NEW MON @ 2014.6352
 LLH 48 7 55.42906 251 40 33.49371 807.4445 NEW L1 PHS CEN @ 2014.6352
 LLH 48 7 55.42903 251 40 33.49374 807.3552 NEW ARP @ 2014.6352
 LLH 48 7 55.42906 251 40 33.49371 805.5552 NEW MON @ 2014.6352

BASELINE NAME: p053 0185
 XYZ 0.4532 0.1394 0.0013 + XYZ ADJUSTMENTS
 XYZ -1340980.5794 -4049053.5639 4727290.7905 NEW L1 PHS CEN @ 2014.6352
 XYZ -1340980.5603 -4049053.5083 4727290.7233 NEW ARP @ 2014.6352
 XYZ -1340980.1830 -4049052.3669 4727289.3836 NEW MON @ 2014.6352
 LLH 48 7 55.42906 251 40 33.49381 807.4370 NEW L1 PHS CEN @ 2014.6352
 LLH 48 7 55.42902 251 40 33.49384 807.3478 NEW ARP @ 2014.6352
 LLH 48 7 55.42906 251 40 33.49381 805.5477 NEW MON @ 2014.6352

BASELINE NAME: p052 0185

XYZ 0.4532 0.1399 -0.0031 + XYZ ADJUSTMENTS
 XYZ -1340980.5794 -4049053.5634 4727290.7862 NEW L1 PHS CEN @ 2014.6352
 XYZ -1340980.5603 -4049053.5078 4727290.7190 NEW ARP @ 2014.6352
 XYZ -1340980.1830 -4049052.3664 4727289.3792 NEW MON @ 2014.6352
 LLH 48 7 55.42898 251 40 33.49380 807.4335 NEW L1 PHS CEN @ 2014.6352
 LLH 48 7 55.42894 251 40 33.49383 807.3442 NEW ARP @ 2014.6352
 LLH 48 7 55.42898 251 40 33.49380 805.5442 NEW MON @ 2014.6352

G-FILES

Axx2014 820 14 820

B2014 82019 0 14 82022 8 1 page5 v1209.04IGS 126 1 2 27NGS 2014 821IFDDPX
 IIGS08_1804 IGS 20140803
 C00090002 -844553891 15 650391653 30 302044884 38 X2324A0185X2324AMTMS
 D 1 2 6528380 1 3 -6989428 2 3 -9324420

Axx2014 820 14 820

B2014 82019 0 14 82022 8 1 page5 v1209.04IGS 126 1 2 27NGS 2014 821IFDDPX
 IIGS08_1804 IGS 20140803
 C00090004 574209250 10 332820444 19 438422213 24 X2324A0185X2324AP053
 D 1 2 6960549 1 3 -3840623 2 3 -8783282

Axx2014 820 14 820

B2014 82019 0 14 82022 8 1 page5 v1209.04IGS 126 1 2 27NGS 2014 821IFDDPX
 IIGS08_1804 IGS 20140803
 C00090005 743318461 9 -891421981 17 -565798860 22 X2324A0185X2324AP052
 D 1 2 7066196 1 3 -7411731 2 3 -9083358

POST-FIT RMS BY SATELLITE VS. BASELINE

OVERALL 01 02 04 05 06 10 12 17
 mtms-0185| 0.017 ... 0.013 0.019 0.020 0.012 0.019 0.012 0.021
 20 24 25 28 29 31
 mtms-0185| 0.021 0.017 0.015 0.024 0.021 0.026

OVERALL 01 02 04 05 06 10 12 17
 p053-0185| 0.014 ... 0.010 0.016 0.019 ... 0.017 0.010 0.015
 20 24 25 28 29 31
 p053-0185| 0.020 0.012 0.014 0.017 0.022 0.018

OVERALL 01 02 04 05 06 10 12 17
 p052-0185| 0.013 ... 0.010 0.013 0.011 ... 0.014 0.009 0.012
 20 24 25 28 29 31
 p052-0185| 0.020 0.012 0.011 0.021 0.020 ...

OBS BY SATELLITE VS. BASELINE

OVERALL 01 02 04 05 06 10 12 17
 mtms-0185| 1980 ... 172 150 90 136 158 338 220
 20 24 25 28 29 31
 mtms-0185| 148 235 198 25 72 38
 OVERALL 01 02 04 05 06 10 12 17
 p053-0185| 2421 ... 363 193 105 ... 260 373 269

	20	24	25	28	29	31			
p053-0185	150	275	244	99	86	4			
	OVERALL	01	02	04	05	06	10	12	17
p052-0185	2392	...	372	202	83	...	256	373	249
	20	24	25	28	29	31			
p052-0185	167	284	234	100	72	...			

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

0.0000012044	0.0000001653	-0.0000001913
0.0000001653	0.0000045644	-0.0000005396
-0.0000001913	-0.0000005396	0.0000072133

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

0.0000014379	-0.0000006540	0.0000005741
-0.0000006540	0.0000050551	0.0000013749
0.0000005741	0.0000013749	0.0000064892

Horizontal network accuracy = 0.00464 meters.

Vertical network accuracy = 0.00499 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)	
MTMS	-1425434.69795	-3984014.42122	4757493.88638	2010.00
P053	-1283558.38336	-4015771.55123	4771131.61488	2010.00
P052	-1266647.47169	-4138195.81057	4670709.52375	2010.00

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

	Xr(m)	Yr(m)	Zr(m)	
MTMS	-1425434.69795	-3984014.42122	4757493.88638	2010.00
P053	-1283558.38166	-4015771.54603	4771131.60868	2010.00
P052	-1266647.47009	-4138195.80517	4670709.51765	2010.00

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

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
MTMS	-0.01650	-0.00090	-0.00660
P053	-0.01640	-0.00040	-0.00470
P052	-0.01580	0.00030	-0.00570

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)	
MTMS	-84455.38895	65039.17278	30204.49238	2010.00
P053	57420.92734	33282.04797	43842.21468	2010.00
P052	74331.83891	-89142.21117	-56579.87635	2010.00

STATE PLANE COORDINATES - International Foot

SPC (2500 MT)

Northing (Y) [feet] 1417421.355

Easting (X) [feet]	2255559.531
Convergence [degrees]	0.86023931
Point Scale	0.99958418
Combined Factor	0.99945790

** 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: 821.488 (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.