OPUS 61D PRECISE.txt

From: opus <opus@ngs.noaa.gov>
Sent: Tuesday, February 11, 2025 10:50 AM
To: Patrick Rockwell
Subject: OPUS solution : 61D_6216_0719_144157.m00 OP1739288851955

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help or have questions/concerns.

FILE: 61D_6216_0719_144157.m00 OP1739288851955

NGS OPUS SOLUTION REPORT

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: https://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: prockwell@norfolkcounty.org DATE: February 11, 2025
RINEX FILE: 61d_200n.23o TIME: 15:50:00 UTC

SOFTWARE: page5 2008.25 master278.pl 160321 START: 2023/07/19 13:43:00
EPHEMERIS: igs22713.eph [precise] STOP: 2023/07/19 18:01:00
NAV FILE: brdc2000.23n OBS USED: 7286 / 8758 : 83%
ANT NAME: LEIGS12 NONE # FIXED AMB: 73 / 75 : 97%
ARP HEIGHT: 2.000 OVERALL RMS: 0.019(m)

REF FRAME:	NAD_83(2011)(EPOCH:2010.0000)		ITRF2014 (EPOCH:2023.5470)	
X:	1525669.216(m)	0.011(m)	1525668.228(m)	0.011(m)
Y:	-4475549.944(m)	0.029(m)	-4475548.524(m)	0.029(m)
Z:	4266126.338(m)	0.011(m)	4266126.353(m)	0.011(m)
LAT:	42 14 56.62342	0.012(m)	42 14 56.65999	0.012(m)
E LON:	288 49 25.38678	0.003(m)	288 49 25.36597	0.003(m)
W LON:	71 10 34.61322	0.003(m)	71 10 34.63403	0.003(m)
EL HGT:	5.786(m)	0.030(m)	4.565(m)	0.030(m)
ORTHO HGT:	33.976(m)	0.065(m)	[NAVD88 (Computed using GEOID18)]	

	UTM COORDINATES (Zone 19)	STATE PLANE COORDINATES (2001 MA M)
Northing (Y) [meters]	4679722.976	888783.785
Easting (X) [meters]	320465.863	226714.486
Convergence [degrees]	-1.46362222	0.21745000

Point Scale	0.99999661	0.99996491
Combined Factor	0.99999570	0.99996400

US NATIONAL GRID DESIGNATOR: 19TCG2046679723(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DR6404	MAWR MAWR WRENTHAM CORS GRP	N420230.133	W0711815.039	25343.1
DR8083	MATB MATB TEWKSBURY GRP	N423748.003	W0711617.322	43034.1
DF9215	ZBW1 BOSTON WAAS 1 CORS ARP	N424408.558	W0712849.518	59560.4

NEAREST NGS PUBLISHED CONTROL POINT

MY3591	DEDHAM CRTHSE FLAGPOLE	N421455.299	W0711034.136	42.3

BASE STATION INFORMATION

STATION NAME: mawr a 1 (MAWR WRENTHAM; Wrentham, Massachusetts United Sta
MONUMENT: NO DOMES NUMBER

XYZ	1520635.6859	-4493604.3416	4249069.6125	MON @ 2010.0000 (M)
XYZ	-0.0155	-0.0013	0.0039	VEL (M/YR)
NEU	-0.0000	0.0000	0.0350	MON TO ARP (M)
NEU	0.0005	0.0001	0.1249	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	-0.0002	0.1335	ARP TO L2 PHASE CENTER (M)
XYZ	-0.2100	-0.0176	0.0528	VEL TIMES 13.5462 YRS
XYZ	0.0083	-0.0246	0.0234	MON TO ARP
XYZ	0.0297	-0.0875	0.0840	ARP TO L1 PHASE CENTER
XYZ	1520635.5140	-4493604.4713	4249069.7727	L1 PHS CEN @ 2023.5470
XYZ	-0.0000	-0.0000	0.0000	+ XYZ ADJUSTMENTS
XYZ	1520635.5140	-4493604.4713	4249069.7727	NEW L1 PHS CEN @ 2023.5470
XYZ	1520635.4842	-4493604.3838	4249069.6887	NEW ARP @ 2023.5470
XYZ	1520635.4759	-4493604.3592	4249069.6653	NEW MON @ 2023.5470
LLH	42 2 30.17021	288 41 44.93945	35.5940	NEW L1 PHS CEN @ 2023.5470
LLH	42 2 30.17020	288 41 44.93944	35.4691	NEW ARP @ 2023.5470
LLH	42 2 30.17020	288 41 44.93944	35.4341	NEW MON @ 2023.5470

STATION NAME: matb a 1 (MATB TEWKSBURY; Tewksbury, Massachusetts USA)
MONUMENT: NO DOMES NUMBER

XYZ	1509063.4164	-4451039.4259	4297359.5661	MON @ 2010.0000 (M)
XYZ	-0.0156	-0.0014	0.0038	VEL (M/YR)
NEU	-0.0000	0.0000	0.0350	MON TO ARP (M)
NEU	0.0005	0.0001	0.1249	ARP TO L1 PHASE CENTER (M)
NEU	0.0001	-0.0002	0.1335	ARP TO L2 PHASE CENTER (M)
XYZ	-0.2113	-0.0190	0.0515	VEL TIMES 13.5462 YRS
XYZ	0.0083	-0.0244	0.0237	MON TO ARP

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XYZ         0.0295        -0.0867         0.0849  ARP TO L1 PHASE CENTER
XYZ   1509063.2429  -4451039.5559   4297359.7262  L1 PHS CEN @ 2023.5470
XYZ        -0.0000        -0.0000        -0.0000  + XYZ ADJUSTMENTS
XYZ   1509063.2429  -4451039.5559   4297359.7262  NEW L1 PHS CEN @ 2023.5470
XYZ   1509063.2134  -4451039.4693   4297359.6413  NEW ARP @ 2023.5470
XYZ   1509063.2051  -4451039.4449   4297359.6176  NEW MON @ 2023.5470
LLH  42 37 48.03979  288 43 42.65676     12.0804  NEW L1 PHS CEN @ 2023.5470
LLH  42 37 48.03977  288 43 42.65676     11.9555  NEW ARP @ 2023.5470
LLH  42 37 48.03977  288 43 42.65676     11.9205  NEW MON @ 2023.5470

STATION NAME: zbw1  a    2 (BOSTON WAAS 1; Boston, Massachusetts, U.S.A.)
 MONUMENT: NO DOMES NUMBER
XYZ   1490299.1715  -4448982.8607   4306010.1790  MON @ 2010.0000 (M)
XYZ        -0.0159        -0.0010         0.0034  VEL (M/YR)
NEU         0.0000         0.0000         0.0000  MON TO ARP (M)
NEU         0.0009        -0.0040         0.4444  ARP TO L1 PHASE CENTER (M)
NEU        -0.0011        -0.0011         0.4571  ARP TO L2 PHASE CENTER (M)
XYZ        -0.2154        -0.0137         0.0459  VEL TIMES 13.5462 YRS
XYZ         0.0000         0.0000         0.0000  MON TO ARP
XYZ         0.0997        -0.3103         0.3022  ARP TO L1 PHASE CENTER
XYZ   1490299.0559  -4448983.1846   4306010.5272  L1 PHS CEN @ 2023.5470
XYZ         0.0000         0.0000        -0.0000  + XYZ ADJUSTMENTS
XYZ   1490299.0559  -4448983.1846   4306010.5272  NEW L1 PHS CEN @ 2023.5470
XYZ   1490298.9562  -4448982.8744   4306010.2250  NEW ARP @ 2023.5470
XYZ   1490298.9562  -4448982.8744   4306010.2250  NEW MON @ 2023.5470
LLH  42 44  8.59540  288 31 10.45986     39.1068  NEW L1 PHS CEN @ 2023.5470
LLH  42 44  8.59537  288 31 10.46003     38.6624  NEW ARP @ 2023.5470
LLH  42 44  8.59537  288 31 10.46003     38.6624  NEW MON @ 2023.5470

                        REMOTE STATION INFORMATION

STATION NAME: 61d_       1
 MONUMENT: NO DOMES NUMBER
XYZ   1525668.2182  -4475548.8356   4266126.9018  MON @ 2023.5468 (M)
NEU         0.0013        -0.0013         2.0000  MON TO ARP (M)
NEU        -0.0013         0.0013         0.0872  ARP TO L1 PHASE CENTER (M)
NEU         0.0002        -0.0012         0.0847  ARP TO L2 PHASE CENTER (M)
XYZ         0.4762        -1.4009         1.3457  MON TO ARP
XYZ         0.0223        -0.0615         0.0577  ARP TO L1 PHASE CENTER
XYZ   1525668.7167  -4475550.2980   4266128.3051  L1 PHS CEN @ 2023.5470

BASELINE NAME:   mawr  61d_
XYZ         0.0098         0.3162        -0.5507  + XYZ ADJUSTMENTS
XYZ   1525668.7265  -4475549.9817   4266127.7544  NEW L1 PHS CEN @ 2023.5470
XYZ   1525668.7042  -4475549.9202   4266127.6968  NEW ARP @ 2023.5470
XYZ   1525668.2280  -4475548.5194   4266126.3511  NEW MON @ 2023.5470
LLH  42 14 56.66005  288 49 25.36604      6.6480  NEW L1 PHS CEN @ 2023.5470
LLH  42 14 56.66009  288 49 25.36599      6.5608  NEW ARP @ 2023.5470
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 LLH  42 14 56.66005  288 49 25.36604      4.5608  NEW MON @ 2023.5470

 BASELINE NAME:   matb  61d_
 XYZ         0.0040         0.3244        -0.5530  + XYZ ADJUSTMENTS
 XYZ   1525668.7207  -4475549.9735   4266127.7521  NEW L1 PHS CEN @ 2023.5470
 XYZ   1525668.6984  -4475549.9120   4266127.6945  NEW ARP @ 2023.5470
 XYZ   1525668.2222  -4475548.5112   4266126.3488  NEW MON @ 2023.5470
 LLH  42 14 56.66021  288 49 25.36592      6.6393  NEW L1 PHS CEN @ 2023.5470
 LLH  42 14 56.66025  288 49 25.36586      6.5521  NEW ARP @ 2023.5470
 LLH  42 14 56.66021  288 49 25.36592      4.5521  NEW MON @ 2023.5470

 BASELINE NAME:   zbw1  61d_
 XYZ         0.0148         0.2957        -0.5416  + XYZ ADJUSTMENTS
 XYZ   1525668.7315  -4475550.0022   4266127.7635  NEW L1 PHS CEN @ 2023.5470
 XYZ   1525668.7092  -4475549.9408   4266127.7058  NEW ARP @ 2023.5470
 XYZ   1525668.2330  -4475548.5399   4266126.3602  NEW MON @ 2023.5470
 LLH  42 14 56.65981  288 49 25.36596      6.6696  NEW L1 PHS CEN @ 2023.5470
 LLH  42 14 56.65985  288 49 25.36591      6.5824  NEW ARP @ 2023.5470
 LLH  42 14 56.65981  288 49 25.36596      4.5824  NEW MON @ 2023.5470
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G-FILES

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Axx2023 719  23 719
B2023 7191342  23 71918 0 1 page5 v2008.25IGS     137 1 2 27NGS   2025 211IFDDPF
IIGS20_2343          IGS   20241201
C00090002  -50327521   15 -180558398   50 -170566858   37 X2003A61D_X2003AMAWR
D  1  2 -9009823  1  3  9003228  2  3 -8548543

Axx2023 719  23 719
B2023 7191342  23 71918 0 1 page5 v2008.25IGS     137 1 2 27NGS   2025 211IFDDPF
IIGS20_2343          IGS   20241201
C00090003 -166050170   19  245090663   47  312332688   36 X2003A61D_X2003AMATB
D  1  2 -9401069  1  3  6967632  2  3 -8291734

Axx2023 719  23 719
B2023 7191342  23 71918 0 1 page5 v2008.25IGS     137 1 2 27NGS   2025 211IFDDPF
IIGS20_2343          IGS   20241201
C00090001 -353692768   21  265656655   46  398838648   39 X2003A61D_X2003AZBW1
D  1  2 -8937801  1  3  6143385  2  3 -8426447
```

POST-FIT RMS BY SATELLITE VS. BASELINE

```
            OVERALL     03     04     05     06     09     11     12     13
 mawr-61d_|  0.019    ...    ...  0.018  0.018  0.024  0.019  0.017  0.031
               14     15     17     18     19     20     25     29     30
 mawr-61d_|    ...    ...  0.053    ...  0.021  0.014  0.020  0.020    ...

            OVERALL     03     04     05     06     09     11     12     13
```

matb-61d_|	0.018	...	...	0.020	...	0.020	0.014	0.016	0.023
	14	15	17	18	19	20	25	29	
matb-61d_|	...	...	0.021	...	0.015	0.018	0.021	0.022	

	OVERALL	03	04	05	06	09	11	12	13
zbw1-61d_|	0.020	...	...	0.019	0.016	0.021	0.018	0.022	0.027
	14	15	17	18	19	20	25	29	30
zbw1-61d_|	...	...	0.022	...	0.021	0.018	0.025	0.021	...

OBS BY SATELLITE VS. BASELINE

	OVERALL	03	04	05	06	09	11	12	13
mawr-61d_|	2412	...	...	297	355	9	180	343	68
	14	15	17	18	19	20	25	29	30
mawr-61d_|	...	...	31	...	326	377	212	214	...
	OVERALL	03	04	05	06	09	11	12	13
matb-61d_|	2394	...	...	296	...	19	368	339	61
	14	15	17	18	19	20	25	29	
matb-61d_|	...	...	212	...	299	396	203	201	
	OVERALL	03	04	05	06	09	11	12	13
zbw1-61d_|	2480	...	...	311	361	44	268	343	66
	14	15	17	18	19	20	25	29	30
zbw1-61d_|	...	...	180	...	64	410	271	162	...

ITRF position of 61d_ as determined by individual baselines

	X	Y	Z
mawr	1525668.228	-4475548.519	4266126.351
matb	1525668.222	-4475548.511	4266126.349
zbw1	1525668.233	-4475548.540	4266126.360

Residuals of position determined by individual baselines from the final position

	X	Y	Z	East	North	Up
mawr	0.000	0.004	-0.002	0.002	0.001	-0.004
matb	-0.006	0.012	-0.005	-0.001	0.006	-0.013
zbw1	0.005	-0.016	0.007	-0.000	-0.006	0.017

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

0.0000022822	-0.0000005286	0.0000003288
-0.0000005286	0.0000151667	-0.0000009991
0.0000003288	-0.0000009991	0.0000093022

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

0.0000033007	0.0000023472	-0.0000026183

```
  0.0000023472     0.0000104305    -0.0000023024
 -0.0000026183    -0.0000023024     0.0000130199

 Horizontal network accuracy =    0.00678 meters.
 Vertical network accuracy   =    0.00708 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)	
MAWR	1520636.46239	-4493605.78142	4249069.65266	2010.00
MATB	1509064.19502	-4451040.85849	4297359.60081	2010.00
ZBW1	1490299.95047	-4448984.29168	4306010.21399	2010.00

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

	Xr(m)	Yr(m)	Zr(m)	
MAWR	1520636.45409	-4493605.75682	4249069.62926	2010.00
MATB	1509064.18672	-4451040.83409	4297359.57711	2010.00
ZBW1	1490299.95047	-4448984.29168	4306010.21399	2010.00

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

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
MAWR	0.00190	0.00018	-0.00198
MATB	0.00197	0.00009	-0.00205
ZBW1	0.00170	0.00048	-0.00238

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)	
MAWR	-5032.76191	-18055.81282	-17056.70874	2010.00
MATB	-16605.02928	24509.10991	31233.23911	2010.00
ZBW1	-35369.26553	26565.65232	39883.87599	2010.00

STATE PLANE COORDINATES - U.S. Survey Foot

SPC (2001 MA M)

Northing (Y) [feet]	2915951.468
Easting (X) [feet]	743812.443
Convergence [degrees]	0.21745000
Point Scale	0.99996491
Combined Factor	0.99996400

********** New Reference Frame Preview **********

We are replacing the nation's NAD 83 and NAVD 88 datums, to improve access and accuracy of the

National Spatial Reference System. More at
https://geodesy.noaa.gov/datums/newdatums/

Below are approximate coordinates for this solution in the new frames:

APPROX ORTHO HGT: 33.634 (m) [PROTOTYPE (Computed using
xGeoid19B,GRS80,ITRF2014)]

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.