

Lee Drennan

From: opus <opus@ngs.noaa.gov>
Sent: Tuesday, November 24, 2015 2:27 PM
To: Lee Drennan
Subject: OPUS solution : Project 11119-04 : 04143210.15o OP1448396711291

FILE: 04143210.15o OP1448396711291

NGS OPUS SOLUTION REPORT

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

USER: ldrennan@mphinc.com DATE: November 24, 2015
RINEX FILE: 0414321o.15o TIME: 20:27:03 UTC

SOFTWARE: page5 1209.04 master51.pl 022814 START: 2015/11/17 14:58:00
EPHEMERIS: igr18712.eph [rapid] STOP: 2015/11/17 21:10:00
NAV FILE: brdc3210.15n OBS USED: 14850 / 16225 : 92%
ANT NAME: TRMR10 NONE # FIXED AMB: 118 / 130 : 91%
ARP HEIGHT: 2.05 OVERALL RMS: 0.019(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2015.8788)

X: -25006.659(m) 0.009(m) -25007.447(m) 0.009(m)
Y: -5557626.546(m) 0.005(m) -5557625.042(m) 0.005(m)
Z: 3118802.249(m) 0.010(m) 3118802.064(m) 0.010(m)

LAT: 29 27 51.63756 0.011(m) 29 27 51.65630 0.011(m)
E LON: 269 44 31.91337 0.009(m) 269 44 31.88388 0.009(m)
W LON: 90 15 28.08663 0.009(m) 90 15 28.11612 0.009(m)
EL HGT: -24.389(m) 0.002(m) -25.787(m) 0.002(m)
ORTHO HGT: 0.287(m) 0.012(m) [NAVD88 (Computed using GEOID12B)]

| | UTM COORDINATES | STATE PLANE COORDINATES |
|-----------------------|-----------------|-------------------------|
| | UTM (Zone 15) | SPC (1702 LA S) |
| Northing (Y) [meters] | 3262564.567 | 107383.154 |
| Easting (X) [meters] | 765940.244 | 1104322.070 |
| Convergence [degrees] | 1.34963061 | 0.53777939 |
| Point Scale | 1.00047276 | 0.99996928 |
| Combined Factor | 1.00047659 | 0.99997311 |

US NATIONAL GRID DESIGNATOR: 15RYN6594062564(NAD 83)

BASE STATIONS USED

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|--------|---------------------------------|-------------|--------------|-------------|
| DP7419 | INRI LOYOLA UNIVERSITY CORS ARP | N295613.211 | W0900707.837 | 54091.0 |
| DJ9603 | LWES LAKEWOOD ELMENTRY CORS ARP | N295401.295 | W0902057.833 | 49137.3 |
| DF5771 | LMCN LUMCON CORS ARP | N291517.904 | W0903940.652 | 45535.9 |

NEAREST NGS PUBLISHED CONTROL POINT

| | | | | |
|--------|------------|-------------|--------------|--------|
| AU3008 | FINIS 1934 | N292838.324 | W0901522.002 | 1452.9 |
|--------|------------|-------------|--------------|--------|

BASE STATION INFORMATION

STATION NAME: inri a 1 (Loyola University; New Orleans, Louisiana USA)

MONUMENT: NO DOMES NUMBER

| | | | | |
|-----|----------------|-----------------|--------------|----------------------------|
| XYZ | -11474.6510 | -5531723.6107 | 3164319.3421 | MON @ 2005.0000 (M) |
| XYZ | -0.0124 | -0.0004 | -0.0008 | 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 | -0.1349 | -0.0044 | -0.0087 | VEL TIMES 10.8770 YRS |
| XYZ | 0.0000 | 0.0000 | 0.0000 | MON TO ARP |
| XYZ | -0.0004 | -0.0573 | 0.0343 | ARP TO L1 PHASE CENTER |
| XYZ | -11474.7863 | -5531723.6724 | 3164319.3677 | L1 PHS CEN @ 2015.8788 |
| XYZ | -0.0000 | -0.0000 | -0.0000 | + XYZ ADJUSTMENTS |
| XYZ | -11474.7863 | -5531723.6724 | 3164319.3677 | NEW L1 PHS CEN @ 2015.8788 |
| XYZ | -11474.7859 | -5531723.6151 | 3164319.3334 | NEW ARP @ 2015.8788 |
| XYZ | -11474.7859 | -5531723.6151 | 3164319.3334 | NEW MON @ 2015.8788 |
| LLH | 29 56 13.23099 | 269 52 52.13315 | -10.4998 | NEW L1 PHS CEN @ 2015.8788 |
| LLH | 29 56 13.23095 | 269 52 52.13316 | -10.5665 | NEW ARP @ 2015.8788 |
| LLH | 29 56 13.23095 | 269 52 52.13316 | -10.5665 | NEW MON @ 2015.8788 |

STATION NAME: lwes a 2 (Lakewood Elmentry; Luling, Louisiana USA)

MONUMENT: NO DOMES NUMBER

| | | | | |
|-----|---------------|----------------|--------------|----------------------------|
| XYZ | -33746.1306 | -5533652.9612 | 3160795.4536 | MON @ 2005.0000 (M) |
| XYZ | -0.0116 | 0.0036 | -0.0021 | 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 | -0.1263 | 0.0390 | -0.0225 | VEL TIMES 10.8770 YRS |
| XYZ | 0.0000 | 0.0000 | 0.0000 | MON TO ARP |
| XYZ | -0.0007 | -0.0573 | 0.0342 | ARP TO L1 PHASE CENTER |
| XYZ | -33746.2576 | -5533652.9795 | 3160795.4653 | L1 PHS CEN @ 2015.8788 |
| XYZ | -0.0000 | -0.0000 | -0.0000 | + XYZ ADJUSTMENTS |
| XYZ | -33746.2576 | -5533652.9795 | 3160795.4653 | NEW L1 PHS CEN @ 2015.8788 |
| XYZ | -33746.2569 | -5533652.9222 | 3160795.4310 | NEW ARP @ 2015.8788 |
| XYZ | -33746.2569 | -5533652.9222 | 3160795.4310 | NEW MON @ 2015.8788 |
| LLH | 29 54 1.31466 | 269 39 2.13670 | -17.0523 | NEW L1 PHS CEN @ 2015.8788 |
| LLH | 29 54 1.31462 | 269 39 2.13671 | -17.1191 | NEW ARP @ 2015.8788 |
| LLH | 29 54 1.31462 | 269 39 2.13671 | -17.1191 | NEW MON @ 2015.8788 |

STATION NAME: lmcn a 5 (LUMCON; Cocodrie, Louisiana, U.S.A.)

MONUMENT: NO DOMES NUMBER

XYZ -64275.9132 -5568696.9126 3098580.6444 MON @ 2005.0000 (M)
XYZ -0.0106 0.0052 -0.0045 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 -0.1156 0.0561 -0.0494 VEL TIMES 10.8770 YRS
XYZ 0.0000 0.0000 0.0000 MON TO ARP
XYZ -0.0010 -0.0577 0.0336 ARP TO L1 PHASE CENTER
XYZ -64276.0298 -5568696.9142 3098580.6286 L1 PHS CEN @ 2015.8788
XYZ -0.0000 0.0000 0.0000 + XYZ ADJUSTMENTS
XYZ -64276.0298 -5568696.9142 3098580.6286 NEW L1 PHS CEN @ 2015.8788
XYZ -64276.0288 -5568696.8565 3098580.5950 NEW ARP @ 2015.8788
XYZ -64276.0288 -5568696.8565 3098580.5950 NEW MON @ 2015.8788
LLH 29 15 17.92270 269 20 19.31843 -16.1109 NEW L1 PHS CEN @ 2015.8788
LLH 29 15 17.92266 269 20 19.31844 -16.1776 NEW ARP @ 2015.8788
LLH 29 15 17.92266 269 20 19.31844 -16.1776 NEW MON @ 2015.8788

REMOTE STATION INFORMATION

STATION NAME: 0414 1

MONUMENT: NO DOMES NUMBER

XYZ -25007.5231 -5557624.9654 3118802.1373 MON @ 2015.8784 (M)
NEU 0.0009 0.0007 2.0500 MON TO ARP (M)
NEU -0.0009 -0.0006 0.1284 ARP TO L1 PHASE CENTER (M)
NEU -0.0027 -0.0064 0.1197 ARP TO L2 PHASE CENTER (M)
XYZ -0.0074 -1.7844 1.0092 MON TO ARP
XYZ -0.0012 -0.1122 0.0623 ARP TO L1 PHASE CENTER
XYZ -25007.5316 -5557626.8620 3118803.2088 L1 PHS CEN @ 2015.8788

BASELINE NAME: inri 0414

XYZ 0.0780 -0.0744 -0.0673 + XYZ ADJUSTMENTS
XYZ -25007.4536 -5557626.9364 3118803.1415 NEW L1 PHS CEN @ 2015.8788
XYZ -25007.4525 -5557626.8242 3118803.0792 NEW ARP @ 2015.8788
XYZ -25007.4451 -5557625.0398 3118802.0700 NEW MON @ 2015.8788
LLH 29 27 51.65650 269 44 31.88395 -23.6072 NEW L1 PHS CEN @ 2015.8788
LLH 29 27 51.65653 269 44 31.88397 -23.7356 NEW ARP @ 2015.8788
LLH 29 27 51.65650 269 44 31.88395 -25.7856 NEW MON @ 2015.8788

BASELINE NAME: lwes 0414

XYZ 0.0802 -0.0759 -0.0746 + XYZ ADJUSTMENTS
XYZ -25007.4515 -5557626.9379 3118803.1343 NEW L1 PHS CEN @ 2015.8788
XYZ -25007.4503 -5557626.8257 3118803.0719 NEW ARP @ 2015.8788
XYZ -25007.4429 -5557625.0413 3118802.0627 NEW MON @ 2015.8788
LLH 29 27 51.65628 269 44 31.88403 -23.6095 NEW L1 PHS CEN @ 2015.8788
LLH 29 27 51.65630 269 44 31.88405 -23.7379 NEW ARP @ 2015.8788
LLH 29 27 51.65628 269 44 31.88403 -25.7879 NEW MON @ 2015.8788

BASELINE NAME: lmcn 0414

XYZ 0.0709 -0.0792 -0.0772 + XYZ ADJUSTMENTS
XYZ -25007.4607 -5557626.9412 3118803.1316 NEW L1 PHS CEN @ 2015.8788
XYZ -25007.4596 -5557626.8290 3118803.0692 NEW ARP @ 2015.8788

XYZ -25007.4522 -5557625.0446 3118802.0601 NEW MON @ 2015.8788
 LLH 29 27 51.65615 269 44 31.88369 -23.6079 NEW L1 PHS CEN @ 2015.8788
 LLH 29 27 51.65617 269 44 31.88371 -23.7363 NEW ARP @ 2015.8788
 LLH 29 27 51.65615 269 44 31.88369 -25.7863 NEW MON @ 2015.8788

G-FILES

Axx20151117 151117
 B201511171458 15111721 9 1 page5 v1209.04IGS 126 1 2 27NGS 20151124IFDDPX
 IIGS08_1869 IGS 20151101
 C00090004 135326592 4 259014247 23 455172634 14 X3215A0414X3215AINRI
 D 1 2 189665 1 3 889537 2 3 -8378311

Axx20151117 151117
 B201511171458 15111721 9 1 page5 v1209.04IGS 126 1 2 27NGS 20151124IFDDPX
 IIGS08_1869 IGS 20151101
 C00090003 -87388140 4 239721191 22 419933683 14 X3215A0414X3215ALWES
 D 1 2 -1299134 1 3 163896 2 3 -8261596

Axx20151117 151117
 B201511171458 15111721 9 1 page5 v1209.04IGS 126 1 2 27NGS 20151124IFDDPX
 IIGS08_1869 IGS 20151101
 C00090002 -392685767 5 -110718119 21 -202214650 13 X3215A0414X3215ALMCN
 D 1 2 1103071 1 3 736335 2 3 -9049821

POST-FIT RMS BY SATELLITE VS. BASELINE

OVERALL 02 05 06 09 12 13 14 15
 inri-0414| 0.020 0.019 0.027 0.024 0.024 0.016 0.020 0.024 0.019
 17 18 20 21 22 24 25 27 29
 inri-0414| ... 0.020 0.020 0.018 0.028 0.020 0.018 0.026 0.020

OVERALL 02 05 06 09 12 13 14 15
 lwes-0414| 0.018 0.018 0.023 0.021 0.017 0.017 0.018 0.019 0.020
 17 18 20 21 22 24 25 27 29
 lwes-0414| 0.035 0.016 0.019 0.015 0.017 0.018 0.020 0.020 0.019

OVERALL 02 05 06 09 12 13 14 15
 lmcn-0414| 0.017 0.015 0.020 0.021 ... 0.017 0.018 0.016 0.017
 17 18 20 21 22 24 25 27 29
 lmcn-0414| ... 0.016 0.019 0.015 0.015 0.017 0.019 0.017 0.016

OBS BY SATELLITE VS. BASELINE

OVERALL 02 05 06 09 12 13 14 15
 inri-0414| 4811 425 86 186 27 293 466 138 229
 17 18 20 21 22 24 25 27 29
 inri-0414| ... 413 707 451 171 209 347 39 624
 OVERALL 02 05 06 09 12 13 14 15
 lwes-0414| 5158 445 96 188 20 311 549 108 259
 17 18 20 21 22 24 25 27 29
 lwes-0414| 43 383 729 463 174 268 387 99 636

```

OVERALL 02 05 06 09 12 13 14 15
lmcn-0414| 4881 434 87 157 ... 310 534 82 237
      17 18 20 21 22 24 25 27 29
lmcn-0414| ... 425 683 445 185 265 364 70 603

```

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

```

0.0000001711 -0.0000000029 0.0000000009
-0.0000000029 0.0000031311 -0.0000001696
0.0000000009 -0.0000001696 0.0000011867

```

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

```

0.0000001712 -0.0000000065 0.0000000149
-0.0000000065 0.0000015076 -0.0000007414
0.0000000149 -0.0000007414 0.0000028101

```

Horizontal network accuracy = 0.00244 meters.

Vertical network accuracy = 0.00329 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)
INRI -11473.99602 -5531725.11444 3164319.51370 2010.00
LWES -33745.47186 -5533654.44424 3160795.61899 2010.00
LMCN -64275.25142 -5568698.39417 3098580.80219 2010.00

```

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

```

      Xr(m)   Yr(m)   Zr(m)
INRI -11473.99602 -5531725.11444 3164319.51370 2010.00
LWES -33745.47186 -5533654.44424 3160795.61899 2010.00
LMCN -64275.25142 -5568698.39417 3098580.80219 2010.00

```

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

```

      Vx (m/yr)  Vy (m/yr)  Vz (m/yr)
INRI    0.00140    0.00060   -0.00060
LWES   -0.01160    0.00360   -0.00210
LMCN   -0.01060    0.00520   -0.00450

```

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)
INRI 13532.66298 25901.43156 45517.26470 2010.00
LWES -8738.81286 23972.10176 41993.36999 2010.00
LMCN -39268.59242 -11071.84817 -20221.44681 2010.00

```

STATE PLANE COORDINATES - U.S. Survey Foot

SPC (1702 LA S)

```

Northing (Y) [feet] 352306.231
Easting (X) [feet] 3623096.658

```

Convergence [degrees] 0.53777939
Point Scale 0.99996928
Combined Factor 0.99997311

** 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: 0.255 (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.