

## OPUS-RS solution : 018697\_14\_241\_A0.14O OP1409698105636

opus &lt;opus@ngs.noaa.gov&gt;

Tue 9/2/2014 4:54 PM

To:John Freetly &lt;John.Freetly@neciusa.com&gt;;

FILE: 018697\_14\_241\_A0.14O OP1409698105636

## NGS OPUS-RS SOLUTION REPORT

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All computed coordinate accuracies are listed as 1-sigma RMS values.

For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>USER: john.freetly@neciusa.com  
RINEX FILE: 0186241p.14oDATE: September 02, 2014  
TIME: 22:53:56 UTCSOFTWARE: rsgps 1.37 RS92.prl 1.99.2      START: 2014/08/29 15:15:00  
EPHEMERIS: igr18075.eph [rapid]      STOP: 2014/08/29 16:19:00  
NAV FILE: brdc2410.14n      OBS USED: 6138 / 6624 : 93%  
ANT NAME: CHCX90D-OPUS    NONE      QUALITY IND. 15.27/ 58.90  
ARP HEIGHT: 1.8000      NORMALIZED RMS:    0.262

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000)      IGS08 (EPOCH:2014.65934)

X: -1322246.159(m) 0.006(m)      -1322247.020(m) 0.006(m)  
Y: -4270214.819(m) 0.006(m)      -4270213.567(m) 0.006(m)  
Z: 4535690.666(m) 0.010(m)      4535690.628(m) 0.010(m)LAT: 45 36 31.44413    0.006(m)      45 36 31.46505    0.006(m)  
E LON: 252 47 42.63927    0.007(m)      252 47 42.58424    0.007(m)  
W LON: 107 12 17.36073    0.007(m)      107 12 17.41576    0.007(m)  
EL HGT:    1062.348(m) 0.010(m)      1061.663(m) 0.010(m)  
ORTHO HGT:    1076.969(m) 0.014(m) [NAVD88 (Computed using GEOID12A)]

## UTM COORDINATES    STATE PLANE COORDINATES

UTM (Zone 13)      SPC (2500 MT )

Northing (Y) [meters]    5052941.056      153628.824  
Easting (X) [meters]    328076.994      778959.761  
Convergence [degrees]    -1.57590494      1.67893205  
Point Scale            0.99996341      0.99968918  
Combined Factor        0.99979689      0.99952271

US NATIONAL GRID DESIGNATOR: 13TCL2807652941(NAD 83)

## BASE STATIONS USED

| PID    | DESIGNATION                    | LATITUDE    | LONGITUDE    | DISTANCE(m) |
|--------|--------------------------------|-------------|--------------|-------------|
| DI3062 | BIL5 BILLINGS 5 CORS ARP       | N455816.237 | W1075947.298 | 73576.1     |
| DM7161 | WYSH SHERIDAN CORS ARP         | N444801.769 | W1070035.715 | 91136.1     |
| DL7728 | P051 BILLINGSAPMT2005 CORS ARP | N454823.741 | W1083246.070 | 106753.3    |
| DL7758 | P722 YNPBASSRCHMT2005 CORS ARP | N452725.985 | W1093415.586 | 185616.7    |
| DI3425 | P052 LRRNCHJRDNMT2006 CORS ARP | N472229.026 | W1070107.185 | 196851.0    |
| DI2260 | P054 TEREKALAKAMT2006 CORS ARP | N455046.833 | W1042629.062 | 216741.6    |

## 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)

|      |              |              |             |
|------|--------------|--------------|-------------|
| bil5 | -1372156.895 | -4223945.784 | 4563650.225 |
| wysh | -1326396.424 | -4335757.879 | 4472504.193 |
| p051 | -1416839.101 | -4223178.944 | 4551064.074 |
| p722 | -1501537.052 | -4223566.605 | 4524171.129 |
| p052 | -1266648.339 | -4138194.570 | 4670709.505 |
| p054 | -1110122.550 | -4310701.945 | 4554151.779 |
| 0186 | -1322247.020 | -4270213.567 | 4535690.628 |

## Covariance matrix of the stations:

|    |             |             |             |             |             |             |             |             |             |
|----|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1  | 1.5690E-07  | 2.9410E-07  | -2.6670E-07 | 2.8720E-09  | -5.4120E-08 | 5.3540E-08  | 2.6450E-09  | -6.4220E-08 | 5.7340E-08  |
| 2  | 2.2540E-09  | -6.9780E-08 | 6.2950E-08  | 1.4310E-09  | -6.1120E-08 | 4.9510E-08  | 6.3900E-10  | -4.5060E-08 | 4.3520E-08  |
| 3  | 2.5750E-08  | -2.4880E-09 | 5.0340E-09  | 2.9410E-07  | 9.8080E-07  | -8.7490E-07 | -6.2580E-08 | -1.8300E-07 | 1.8480E-07  |
| 4  | -7.0550E-08 | -1.6190E-07 | 1.7520E-07  | -5.0050E-08 | -1.3700E-07 | 1.6150E-07  | -4.5830E-08 | -1.7200E-07 | 1.7890E-07  |
| 5  | -4.9570E-10 | 3.2970E-08  | -3.9520E-09 | 5.8840E-08  | 1.7630E-07  | -1.5710E-07 | 5.0490E-08  | 1.6820E-07  | -1.5430E-07 |
| 6  | 5.8840E-08  | 1.7630E-07  | -1.5710E-07 | 5.0490E-08  | 1.6820E-07  | -1.5430E-07 | 4.7140E-08  | 1.7640E-07  | -1.5690E-07 |
| 7  | 2.2030E-09  | -2.2830E-09 | 2.7580E-08  | 2.8720E-09  | -6.2580E-08 | 5.3730E-08  | 1.5090E-07  | 3.0360E-07  | -2.6000E-07 |
| 8  | -2.5300E-10 | -7.0850E-08 | 6.1730E-08  | 4.4630E-09  | -5.7600E-08 | 4.7920E-08  | 6.6920E-09  | -4.7240E-08 | 4.0010E-08  |
| 9  | 2.7370E-08  | -3.4180E-09 | 1.7940E-09  | -5.4120E-08 | -1.8300E-07 | 1.7910E-07  | 3.0360E-07  | 1.1030E-06  | -9.1960E-07 |
| 10 | -3.9760E-08 | -1.9180E-07 | 1.8900E-07  | -7.1470E-08 | -2.1110E-07 | 1.7990E-07  | -8.9380E-08 | -1.6560E-07 | 1.8970E-07  |
| 11 | -9.0620E-09 | 4.1800E-09  | 2.5220E-08  | 5.3540E-08  | 1.8480E-07  | -1.5690E-07 | -2.6000E-07 | -9.1960E-07 | 9.4860E-07  |
| 12 | 5.9320E-08  | 1.8790E-07  | -1.5870E-07 | 4.8700E-08  | 1.7820E-07  | -1.5610E-07 | 4.2740E-08  | 1.8270E-07  | -1.5230E-07 |
| 13 | 6.9520E-10  | 8.5510E-09  | 2.6790E-08  | 2.6450E-09  | -6.4490E-08 | 5.5990E-08  | 1.8820E-09  | -4.9010E-08 | 5.5520E-08  |
| 14 | 7           | 2.6450E-09  | -6.4490E-08 | 5.5990E-08  | 1.8820E-09  | -4.9010E-08 | 5.5520E-08  | 1.6830E-07  | 3.0390E-07  |
| 15 |             |             |             |             |             |             |             |             | -2.7720E-07 |

6.5370E-09 -7.3700E-08 6.5710E-08 -3.6860E-09 -7.2980E-08 5.3080E-08 -8.8080E-09 -4.4150E-08 4.7260E-08  
 2.2390E-08 -7.8330E-09 1.2000E-08  
 8 -6.4220E-08 -1.6010E-07 1.7490E-07 -6.5390E-08 -1.8590E-07 1.8580E-07 3.0390E-07 9.8530E-07 -8.7770E-07  
 -7.4180E-08 -1.6210E-07 1.7530E-07 -5.1870E-08 -1.3600E-07 1.6180E-07 -4.6970E-08 -1.7450E-07 1.8000E-07  
 -3.8870E-09 2.8830E-08 -7.0890E-10  
 9 5.7340E-08 1.7450E-07 -1.5650E-07 5.6460E-08 1.8210E-07 -1.5760E-07 -2.7720E-07 -8.7770E-07 9.4900E-07  
 6.2730E-08 1.7610E-07 -1.5680E-07 5.1950E-08 1.6620E-07 -1.5410E-07 4.7640E-08 1.7870E-07 -1.5760E-07  
 5.2030E-09 1.1120E-09 2.4590E-08  
 10 2.2540E-09 -7.0550E-08 5.8840E-08 -2.5300E-10 -3.9760E-08 5.9320E-08 6.5370E-09 -7.4180E-08 6.2730E-08  
 0.19890E-07 3.2170E-07 -2.9440E-07 -1.3500E-08 -9.5310E-08 5.9840E-08 -2.6690E-08 -4.2760E-08 5.4400E-08  
 1.6650E-08 -1.6110E-08 2.3450E-08  
 11 -6.9780E-08 -1.6190E-07 1.7630E-07 -7.0850E-08 -1.9180E-07 1.8790E-07 -7.3700E-08 -1.6210E-07 1.7610E-07  
 3.2170E-07 9.9620E-07 -8.8450E-07 -5.5510E-08 -1.3440E-07 1.6240E-07 -4.9320E-08 -1.7950E-07 1.8210E-07  
 -8.5790E-09 2.6530E-08 -6.9040E-11  
 12 6.2950E-08 1.7520E-07 -1.5710E-07 6.1730E-08 1.8900E-07 -1.5870E-07 6.5710E-08 1.7530E-07 -1.5680E-07  
 -2.9440E-07 -8.8450E-07 9.5090E-07 5.4280E-08 1.6130E-07 -1.5340E-07 4.7550E-08 1.8370E-07 -1.5840E-07  
 9.0910E-09 1.6940E-09 2.6240E-08  
 13 1.4310E-09 -5.0050E-08 5.0490E-08 4.4630E-09 -7.1470E-08 4.8700E-08 -3.6860E-09 -5.1870E-08 5.1950E-08  
 -1.3500E-08 -5.5510E-08 5.4280E-08 1.4720E-07 2.7800E-07 -2.3870E-07 3.0660E-08 -4.8570E-08 3.3070E-08  
 3.3440E-08 1.0770E-08 -1.2620E-08  
 14 -6.1120E-08 -1.3700E-07 1.6820E-07 -5.7600E-08 -2.1110E-07 1.7820E-07 -7.2980E-08 -1.3600E-07 1.6620E-07  
 -9.5310E-08 -1.3440E-07 1.6130E-07 2.7800E-07 9.6220E-07 -8.3640E-07 8.3080E-09 -1.7600E-07 1.6220E-07  
 1.4500E-08 5.5920E-08 -3.0790E-08  
 15 4.9510E-08 1.6150E-07 -1.5430E-07 4.7920E-08 1.7990E-07 -1.5610E-07 5.3080E-08 1.6180E-07 -1.5410E-07  
 5.9840E-08 1.6240E-07 -1.5340E-07 -2.3870E-07 -8.3640E-07 9.3730E-07 2.9430E-08 1.7120E-07 -1.5320E-07  
 -5.1760E-09 -1.1170E-08 3.0270E-08  
 16 6.3900E-10 -4.5830E-08 4.7140E-08 6.6920E-09 -8.9380E-08 4.2740E-08 -8.8080E-09 -4.6970E-08 4.7640E-08  
 -2.6690E-08 -4.9320E-08 4.7550E-08 3.0660E-08 8.3080E-09 2.9430E-08 1.6350E-07 2.2430E-07 -2.1550E-07  
 4.0980E-08 1.8960E-08 -2.9660E-08  
 17 -4.5060E-08 -1.7200E-07 1.7640E-07 -4.7240E-08 -1.6560E-07 1.8270E-07 -4.4150E-08 -1.7450E-07 1.7870E-07  
 -4.2760E-08 -1.7950E-07 1.8370E-07 -4.8570E-08 -1.7600E-07 1.7120E-07 2.2430E-07 1.0340E-06 -8.9290E-07  
 7.5780E-09 1.8150E-08 1.0100E-08  
 18 4.3520E-08 1.7890E-07 -1.5690E-07 4.0010E-08 1.8970E-07 -1.5230E-07 4.7260E-08 1.8000E-07 -1.5760E-07  
 5.4400E-08 1.8210E-07 -1.5840E-07 3.3070E-08 1.6220E-07 -1.5320E-07 -2.1550E-07 -8.9290E-07 9.4550E-07  
 -1.2140E-08 2.0160E-09 3.1440E-08  
 19 2.5750E-08 -4.9570E-10 2.2030E-09 2.7370E-08 -9.0620E-09 6.9520E-10 2.2390E-08 -3.8870E-09 5.2030E-09  
 1.6650E-08 -8.5790E-09 9.0910E-09 3.3440E-08 1.4500E-08 -5.1760E-09 4.0980E-08 7.5780E-09 -1.2140E-08  
 1.6030E-06 3.8980E-06 -3.4930E-06  
 20 -2.4880E-09 3.2970E-08 -2.2830E-09 -3.4180E-09 4.1800E-09 8.5510E-09 -7.8330E-09 2.8830E-08 1.1120E-09  
 -1.6110E-08 2.6530E-08 1.6940E-09 1.0770E-08 5.5920E-08 -1.1170E-08 1.8960E-08 1.8150E-08 2.0160E-09  
 3.8980E-06 1.3250E-05 -1.2080E-05  
 21 5.0340E-09 -3.9520E-09 2.7580E-08 1.7940E-09 2.5220E-08 2.6790E-08 1.2000E-08 -7.0890E-10 2.4590E-08  
 2.3450E-08 -6.9040E-11 2.6240E-08 -1.2620E-08 -3.0790E-08 3.0270E-08 -2.9660E-08 1.0100E-08 3.1440E-08  
 -3.4930E-06 -1.2080E-05 1.2410E-05

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

|               |               |               |
|---------------|---------------|---------------|
| 0.0000016030  | 0.0000038980  | -0.0000034930 |
| 0.0000038980  | 0.0000132500  | -0.0000120800 |
| -0.0000034930 | -0.0000120800 | 0.0000124100  |

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

```

0.0000004192  0.0000001126  0.0000002210
0.0000001126  0.0000008653  -0.0000011945
0.0000002210  -0.0000011945  0.0000259785
    
```

Horizontal network accuracy = 0.00200 meters.  
 Vertical network accuracy = 0.00999 meters.

|      |      | Vectors     |            |            |
|------|------|-------------|------------|------------|
| To   | From | X           | Y          | Z          |
| bil5 | 0186 | -49909.875  | 46267.783  | 27959.597  |
| wysh | 0186 | -4149.404   | -65544.312 | -63186.435 |
| p051 | 0186 | -94592.082  | 47034.623  | 15373.446  |
| p722 | 0186 | -179290.032 | 46646.962  | -11519.499 |
| p052 | 0186 | 55598.681   | 132018.997 | 135018.877 |
| p054 | 0186 | 212124.470  | -40488.377 | 18461.151  |

Covariance matrix of the 6 vectors

```

1  1.7084E-06  4.1951E-06 -3.7669E-06  1.5528E-06  3.8554E-06 -3.4452E-06  1.5575E-06  3.8402E-06 -3.4459E-06
1.5629E-06  3.8393E-06 -3.4442E-06  1.5452E-06  3.8249E-06 -3.4433E-06  1.5369E-06  3.8478E-06 -3.4424E-06
2  4.1951E-06  1.4165E-05 -1.2949E-05  3.8393E-06  1.3030E-05 -1.1900E-05  3.8418E-06  1.3028E-05 -1.1903E-05
3.8441E-06  1.3029E-05 -1.1903E-05  3.8377E-06  1.3024E-05 -1.1903E-05  3.8337E-06  1.3027E-05 -1.1899E-05
3  -3.7669E-06 -1.2949E-05  1.3303E-05 -3.4433E-06 -1.1924E-05  1.2199E-05 -3.4512E-06 -1.1902E-05  1.2201E-05
-3.4598E-06 -1.1901E-05  1.2199E-05 -3.4321E-06 -1.1879E-05  1.2198E-05 -3.4184E-06 -1.1911E-05  1.2194E-05
4  1.5528E-06  3.8393E-06 -3.4433E-06  1.6992E-06  4.2141E-06 -3.7555E-06  1.5551E-06  3.8399E-06 -3.4435E-06
1.5587E-06  3.8391E-06 -3.4422E-06  1.5467E-06  3.8293E-06 -3.4417E-06  1.5413E-06  3.8466E-06 -3.4426E-06
5  3.8554E-06  1.3030E-05 -1.1924E-05  4.2141E-06  1.4345E-05 -1.3033E-05  3.8659E-06  1.3031E-05 -1.1924E-05
3.8834E-06  1.3027E-05 -1.1918E-05  3.8248E-06  1.2979E-05 -1.1914E-05  3.7987E-06  1.3062E-05 -1.1918E-05
6  -3.4452E-06 -1.1900E-05  1.2199E-05 -3.7555E-06 -1.3033E-05  1.3305E-05 -3.4502E-06 -1.1902E-05  1.2201E-05
-3.4578E-06 -1.1901E-05  1.2198E-05 -3.4324E-06 -1.1880E-05  1.2197E-05 -3.4213E-06 -1.1916E-05  1.2199E-05
7  1.5575E-06  3.8418E-06 -3.4512E-06  1.5551E-06  3.8659E-06 -3.4502E-06  1.7265E-06  4.2136E-06 -3.7874E-06
1.5705E-06  3.8407E-06 -3.4484E-06  1.5435E-06  3.8184E-06 -3.4467E-06  1.5308E-06  3.8541E-06 -3.4456E-06
8  3.8402E-06  1.3028E-05 -1.1902E-05  3.8399E-06  1.3031E-05 -1.1902E-05  4.2136E-06  1.4178E-05 -1.2958E-05
3.8438E-06  1.3033E-05 -1.1906E-05  3.8392E-06  1.3029E-05 -1.1906E-05  3.8360E-06  1.3029E-05 -1.1901E-05
9  -3.4459E-06 -1.1903E-05  1.2201E-05 -3.4435E-06 -1.1924E-05  1.2201E-05 -3.7874E-06 -1.2958E-05  1.3310E-05
-3.4589E-06 -1.1905E-05  1.2202E-05 -3.4336E-06 -1.1884E-05  1.2201E-05 -3.4209E-06 -1.1913E-05  1.2196E-05
10  1.5629E-06  3.8441E-06 -3.4598E-06  1.5587E-06  3.8834E-06 -3.4578E-06  1.5705E-06  3.8438E-06 -3.4589E-06
1.7686E-06  4.2444E-06 -3.8199E-06  1.5394E-06  3.8043E-06 -3.4514E-06  1.5187E-06  3.8638E-06 -3.4499E-06
11  3.8393E-06  1.3029E-05 -1.1901E-05  3.8391E-06  1.3027E-05 -1.1901E-05  3.8407E-06  1.3033E-05 -1.1905E-05
4.2444E-06  1.4193E-05 -1.2966E-05  3.8403E-06  1.3033E-05 -1.1906E-05  3.8383E-06  1.3026E-05 -1.1900E-05
12  -3.4442E-06 -1.1903E-05  1.2199E-05 -3.4422E-06 -1.1918E-05  1.2198E-05 -3.4484E-06 -1.1906E-05  1.2202E-05
-3.8199E-06 -1.2966E-05  1.3308E-05 -3.4352E-06 -1.1890E-05  1.2200E-05 -3.4249E-06 -1.1908E-05  1.2194E-05
13  1.5452E-06  3.8377E-06 -3.4321E-06  1.5467E-06  3.8248E-06 -3.4324E-06  1.5435E-06  3.8392E-06 -3.4336E-06
1.5394E-06  3.8403E-06 -3.4352E-06  1.6833E-06  4.1507E-06 -3.7139E-06  1.5592E-06  3.8311E-06 -3.4352E-06
14  3.8249E-06  1.3024E-05 -1.1879E-05  3.8293E-06  1.2979E-05 -1.1880E-05  3.8184E-06  1.3029E-05 -1.1884E-05
3.8043E-06  1.3033E-05 -1.1890E-05  4.1507E-06  1.4100E-05 -1.2874E-05  3.8728E-06  1.3000E-05 -1.1889E-05
15  -3.4433E-06 -1.1903E-05  1.2198E-05 -3.4417E-06 -1.1914E-05  1.2197E-05 -3.4467E-06 -1.1906E-05  1.2201E-05
-3.4514E-06 -1.1906E-05  1.2200E-05 -3.7139E-06 -1.2874E-05  1.3287E-05 -3.4287E-06 -1.1908E-05  1.2195E-05
16  1.5369E-06  3.8337E-06 -3.4184E-06  1.5413E-06  3.7987E-06 -3.4213E-06  1.5308E-06  3.8360E-06 -3.4209E-06
1.5187E-06  3.8383E-06 -3.4249E-06  1.5592E-06  3.8728E-06 -3.4287E-06  1.6845E-06  4.0958E-06 -3.6667E-06
17  3.8478E-06  1.3027E-05 -1.1911E-05  3.8466E-06  1.3062E-05 -1.1916E-05  3.8541E-06  1.3029E-05 -1.1913E-05
    
```

3.8638E-06 1.3026E-05 -1.1908E-05 3.8311E-06 1.3000E-05 -1.1908E-05 4.0958E-06 1.4248E-05 -1.2985E-05  
 18 -3.4424E-06 -1.1899E-05 1.2194E-05 -3.4426E-06 -1.1918E-05 1.2199E-05 -3.4456E-06 -1.1901E-05 1.2196E-05  
 -3.4499E-06 -1.1900E-05 1.2194E-05 -3.4352E-06 -1.1889E-05 1.2195E-05 -3.6667E-06 -1.2985E-05 1.3293E-05

Correlation matrix of the 6 vectors

1 1.0000E+00 8.5279E-01 -7.9016E-01 9.1136E-01 7.7881E-01 -7.2262E-01 9.0688E-01 7.8028E-01 -7.2264E-01  
 8.9910E-01 7.7968E-01 -7.2232E-01 9.1121E-01 7.7930E-01 -7.2273E-01 9.0597E-01 7.7992E-01 -7.2237E-01  
 2 8.5279E-01 1.0000E+00 -9.4328E-01 7.8259E-01 9.1409E-01 -8.6681E-01 7.7687E-01 9.1933E-01 -8.6687E-01  
 7.6801E-01 9.1887E-01 -8.6690E-01 7.8592E-01 9.2157E-01 -8.6767E-01 7.8482E-01 9.1698E-01 -8.6717E-01  
 3 -7.9016E-01 -9.4328E-01 1.0000E+00 -7.2423E-01 -8.6317E-01 9.1692E-01 -7.2013E-01 -8.6665E-01 9.1695E-01  
 -7.1328E-01 -8.6612E-01 9.1683E-01 -7.2527E-01 -8.6732E-01 9.1748E-01 -7.2211E-01 -8.6519E-01 9.1699E-01  
 4 9.1136E-01 7.8259E-01 -7.2423E-01 1.0000E+00 8.5357E-01 -7.8984E-01 9.0795E-01 7.8235E-01 -7.2410E-01  
 8.9916E-01 7.8177E-01 -7.2385E-01 9.1452E-01 7.8233E-01 -7.2435E-01 9.1105E-01 7.8179E-01 -7.2439E-01  
 5 7.7881E-01 9.1409E-01 -8.6317E-01 8.5357E-01 1.0000E+00 -9.4342E-01 7.7682E-01 9.1376E-01 -8.6298E-01  
 7.7100E-01 9.1301E-01 -8.6257E-01 7.7836E-01 9.1259E-01 -8.6300E-01 7.7277E-01 9.1368E-01 -8.6305E-01  
 6 -7.2262E-01 -8.6681E-01 9.1692E-01 -7.8984E-01 -9.4342E-01 1.0000E+00 -7.1986E-01 -8.6659E-01 9.1686E-01  
 -7.1282E-01 -8.6601E-01 9.1670E-01 -7.2528E-01 -8.6732E-01 9.1734E-01 -7.2267E-01 -8.6546E-01 9.1733E-01  
 7 9.0688E-01 7.7687E-01 -7.2013E-01 9.0795E-01 7.7682E-01 -7.1986E-01 1.0000E+00 8.5166E-01 -7.9008E-01  
 8.9875E-01 7.7587E-01 -7.1939E-01 9.0538E-01 7.7388E-01 -7.1964E-01 8.9763E-01 7.7708E-01 -7.1924E-01  
 8 7.8028E-01 9.1933E-01 -8.6665E-01 7.8235E-01 9.1376E-01 -8.6659E-01 8.5166E-01 1.0000E+00 -9.4331E-01  
 7.6762E-01 9.1873E-01 -8.6674E-01 7.8589E-01 9.2151E-01 -8.6749E-01 7.8493E-01 9.1669E-01 -8.6694E-01  
 9 -7.2264E-01 -8.6687E-01 9.1695E-01 -7.2410E-01 -8.6298E-01 9.1686E-01 -7.9008E-01 -9.4331E-01 1.0000E+00  
 -7.1292E-01 -8.6617E-01 9.1684E-01 -7.2541E-01 -8.6749E-01 9.1749E-01 -7.2246E-01 -8.6506E-01 9.1694E-01  
 10 8.9910E-01 7.6801E-01 -7.1328E-01 8.9916E-01 7.7100E-01 -7.1282E-01 8.9875E-01 7.6762E-01 -7.1292E-01  
 1.0000E+00 8.4715E-01 -7.8737E-01 8.9219E-01 7.6181E-01 -7.1199E-01 8.7985E-01 7.6970E-01 -7.1152E-01  
 11 7.7968E-01 9.1887E-01 -8.6612E-01 7.8177E-01 9.1301E-01 -8.6601E-01 7.7587E-01 9.1873E-01 -8.6617E-01  
 8.4715E-01 1.0000E+00 -9.4343E-01 7.8567E-01 9.2129E-01 -8.6702E-01 7.8498E-01 9.1600E-01 -8.6636E-01  
 12 -7.2232E-01 -8.6690E-01 9.1683E-01 -7.2385E-01 -8.6257E-01 9.1670E-01 -7.1939E-01 -8.6674E-01 9.1684E-01  
 -7.8737E-01 -9.4343E-01 1.0000E+00 -7.2578E-01 -8.6794E-01 9.1747E-01 -7.2334E-01 -8.6478E-01 9.1680E-01  
 13 9.1121E-01 7.8592E-01 -7.2527E-01 9.1452E-01 7.7836E-01 -7.2528E-01 9.0538E-01 7.8589E-01 -7.2541E-01  
 8.9219E-01 7.8567E-01 -7.2578E-01 1.0000E+00 8.5197E-01 -7.8530E-01 9.2595E-01 7.8229E-01 -7.2621E-01  
 14 7.7930E-01 9.2157E-01 -8.6732E-01 7.8233E-01 9.1259E-01 -8.6732E-01 7.7388E-01 9.2151E-01 -8.6749E-01  
 7.6181E-01 9.2129E-01 -8.6794E-01 8.5197E-01 1.0000E+00 -9.4060E-01 7.9465E-01 9.1718E-01 -8.6841E-01  
 15 -7.2273E-01 -8.6767E-01 9.1748E-01 -7.2435E-01 -8.6300E-01 9.1734E-01 -7.1964E-01 -8.6749E-01 9.1749E-01  
 -7.1199E-01 -8.6702E-01 9.1747E-01 -7.8530E-01 -9.4060E-01 1.0000E+00 -7.2474E-01 -8.6546E-01 9.1764E-01  
 16 9.0597E-01 7.8482E-01 -7.2211E-01 9.1105E-01 7.7277E-01 -7.2267E-01 8.9763E-01 7.8493E-01 -7.2246E-01  
 8.7985E-01 7.8498E-01 -7.2334E-01 9.2595E-01 7.9465E-01 -7.2474E-01 1.0000E+00 8.3603E-01 -7.7487E-01  
 17 7.7992E-01 9.1698E-01 -8.6519E-01 7.8179E-01 9.1368E-01 -8.6546E-01 7.7708E-01 9.1669E-01 -8.6506E-01  
 7.6970E-01 9.1600E-01 -8.6478E-01 7.8229E-01 9.1718E-01 -8.6546E-01 8.3603E-01 1.0000E+00 -9.4355E-01  
 18 -7.2237E-01 -8.6717E-01 9.1699E-01 -7.2439E-01 -8.6305E-01 9.1733E-01 -7.1924E-01 -8.6694E-01 9.1694E-01  
 -7.1152E-01 -8.6636E-01 9.1680E-01 -7.2621E-01 -8.6841E-01 9.1764E-01 -7.7487E-01 -9.4355E-01 1.0000E+00

G-FILE for the vectors

Axx2014 8292014 829  
 B201408291500201408291600 6 rsgps 1.37IGS  
 lant\_info.003 NGS  
 C00070001 -499098750 13 462677833 37 279595967 36  
 C00070002 -41494042 13 -655443117 37 -631864351 36  
 C00070003 -945920815 13 470346229 37 153734461 36

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C00070004-1792900322 13 466469621 37 -115194990 36
C00070005 555986811 12 1320189971 37 1350188772 36
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D 1 7 9068779 1 8 7802827 1 9 -7226390 1 10 8991016 1 11 7796802
D 1 12 -7223159 1 13 9112092 1 14 7793033 1 15 -7227308 1 16 9059676
D 1 17 7799216 1 18 -7223671 2 3 -9432824 2 4 7825869 2 5 9140889
D 2 6 -8668136 2 7 7768679 2 8 9193332 2 9 -8668656 2 10 7680132
D 2 11 9188663 2 12 -8669026 2 13 7859208 2 14 9215667 2 15 -8676699
D 2 16 7848234 2 17 9169842 2 18 -8671715 3 4 -7242299 3 5 -8631655
D 3 6 9169164 3 7 -7201266 3 8 -8666521 3 9 9169465 3 10 -7132811
D 3 11 -8661235 3 12 9168256 3 13 -7252681 3 14 -8673167 3 15 9174801
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D 4 12 -7238524 4 13 9145183 4 14 7823285 4 15 -7243460 4 16 9110478
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D 6 12 9166999 6 13 -7252765 6 14 -8673163 6 15 9173393 6 16 -7226734
D 6 17 -8654631 6 18 9173348 7 8 8516626 7 9 -7900773 7 10 8987450
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D 8 16 7849302 8 17 9166862 8 18 -8669367 9 10 -7129186 9 11 -8661676
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D 9 17 -8650573 9 18 9169363 10 11 8471515 10 12 -7873695 10 13 8921875
D 10 14 7618068 10 15 -7119921 10 16 8798543 10 17 7697049 10 18 -7115208
D 11 12 -9434257 11 13 7856741 11 14 9212872 11 15 -8670222 11 16 7849805
D 11 17 9159957 11 18 -8663568 12 13 -7257788 12 14 -8679386 12 15 9174665
D 12 16 -7233384 12 17 -8647819 12 18 9168004 13 14 8519734 13 15 -7853039
D 13 16 9259530 13 17 7822863 13 18 -7262056 14 15 -9405972 14 16 7946478
D 14 17 9171777 14 18 -8684121 15 16 -7247422 15 17 -8654601 15 18 9176354
D 16 17 8360296 16 18 -7748710 17 18 -9435497
    
```

ITRF position of 0186 as determined by individual baselines

|      | X            | Y            | Z           |
|------|--------------|--------------|-------------|
| bil5 | -1322247.010 | -4270213.569 | 4535690.628 |
| wysh | -1322247.026 | -4270213.566 | 4535690.633 |
| p051 | -1322247.023 | -4270213.567 | 4535690.628 |
| p722 | -1322247.024 | -4270213.554 | 4535690.616 |
| p052 | -1322247.021 | -4270213.565 | 4535690.609 |
| p054 | -1322247.015 | -4270213.568 | 4535690.625 |

Residuals of position determined by individual baselines from the final position

|      | X      | Y      | Z      | East   | North  | Up     |
|------|--------|--------|--------|--------|--------|--------|
| bil5 | 0.010  | -0.002 | -0.000 | 0.010  | 0.001  | -0.001 |
| wysh | -0.007 | 0.001  | 0.005  | -0.006 | 0.003  | 0.004  |
| p051 | -0.003 | 0.000  | 0.000  | -0.003 | -0.000 | 0.001  |
| p722 | -0.004 | 0.014  | -0.012 | -0.008 | -0.000 | -0.017 |
| p052 | -0.001 | 0.002  | -0.019 | -0.002 | -0.012 | -0.015 |

p054      0.005      -0.001      -0.003      0.005      -0.002      -0.002

## STATE PLANE COORDINATES - International Foot

SPC (2500 MT )

Northing (Y) [feet]      504031.575  
Easting (X) [feet]      2555642.260  
Convergence [degrees]      1.67893205  
Point Scale      0.99968918  
Combined Factor      0.99952271

\*\* 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: 1076.110 (m) [PROTOTYPE (Computed using USGG2012,GRS80,IGS08)]

dop from interpolation is 0.441  
scatter (mean square distance from rover) is 24210.072  
average edop for rover is 0.610  
average ndop for rover is 0.800  
average hdop for rover is 1.006  
average vdop for rover is 1.640  
average gdop for rover is 2.210

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.