

OPUS-RS solution : 018506_14_238_A1.14O OP1409690708702

opus <opus@ngs.noaa.gov>

Tue 9/2/2014 2:49 PM

To: John Freetly <John.Freetly@neciusa.com>;

FILE: 018506_14_238_A1.14O OP1409690708702

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: 0185238s.14oDATE: September 02, 2014
TIME: 20:48:57 UTCSOFTWARE: rsgps 1.37 RS51.prl 1.99.2 START: 2014/08/26 18:10:30
EPHEMERIS: igr18072.eph [rapid] STOP: 2014/08/26 19:51:30
NAV FILE: brdc2380.14n OBS USED: 5778 / 6828 : 85%
ANT NAME: CHCX90D-OPUS NONE QUALITY IND. 42.73/ 16.27
ARP HEIGHT: 1.80000 NORMALIZED RMS: 0.269

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2014.65149)

X: -1314880.525(m) 0.005(m) -1314881.385(m) 0.005(m)
Y: -4279168.399(m) 0.014(m) -4279167.146(m) 0.014(m)
Z: 4529534.731(m) 0.007(m) 4529534.692(m) 0.007(m)LAT: 45 31 44.22775 0.008(m) 45 31 44.24871 0.008(m)
E LON: 252 55 8.85803 0.005(m) 252 55 8.80320 0.005(m)
W LON: 107 4 51.14197 0.005(m) 107 4 51.19680 0.005(m)
EL HGT: 1136.095(m) 0.013(m) 1135.405(m) 0.013(m)
ORTHO HGT: 1150.727(m) 0.016(m) [NAVD88 (Computed using GEOID12A)]

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 13) SPC (2500 MT)

Northing (Y) [meters] 5043819.054 145059.263
Easting (X) [meters] 337512.018 788895.123
Convergence [degrees] -1.48524388 1.76960174
Point Scale 0.99992462 0.99972369
Combined Factor 0.99974655 0.99954566

US NATIONAL GRID DESIGNATOR: 13TCL3751243819(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DM7161	WYSH SHERIDAN CORS ARP	N444801.769	W1070035.715	81163.9
DI3062	BIL5 BILLINGS 5 CORS ARP	N455816.237	W1075947.298	86566.4
DG9745	MTEI ENGINC CORS ARP	N454447.035	W1083600.736	120914.7
DL7758	P722 YNPBASSRCHMT2005 CORS ARP	N452725.985	W1093415.586	194834.6
DI3425	P052 LRRNCHJRDNMT2006 CORS ARP	N472229.026	W1070107.185	205256.0
DI2260	P054 TEREKALAKAMT2006 CORS ARP	N455046.833	W1042629.062	208630.4

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)

wysh	-1326396.429	-4335757.892	4472504.203
bil5	-1372156.892	-4223945.790	4563650.229
mtei	-1422329.056	-4226311.555	4546317.415
p722	-1501537.054	-4223566.610	4524171.131
p052	-1266648.334	-4138194.559	4670709.492
p054	-1110122.544	-4310701.935	4554151.765
0185	-1314881.385	-4279167.146	4529534.692

Covariance matrix of the stations:

1	3.4910E-07	8.5230E-07	-8.9950E-07	-3.4770E-08	-1.7630E-07	1.8610E-07	-3.4890E-08	-1.8490E-07	1.9650E-07
	-3.5970E-08	-1.9960E-07	2.1350E-07	-3.8190E-08	-1.7290E-07	1.6980E-07	-3.8370E-08	-1.1870E-07	1.3360E-07
		2.1470E-08	-1.5860E-08	1.6650E-08					
2	8.5230E-07	2.5970E-06	-2.6190E-06	-1.4900E-07	-4.8840E-07	5.2530E-07	-1.3190E-07	-5.0640E-07	5.5190E-07
	-1.0980E-07	-5.4610E-07	6.0080E-07	-2.0650E-07	-5.5170E-07	5.0770E-07	-2.5490E-07	-3.3850E-07	4.3400E-07
		-4.6290E-08	-6.8440E-08	1.2440E-07					
3	-8.9950E-07	-2.6190E-06	2.8730E-06	1.7760E-07	5.2230E-07	-5.3950E-07	1.7600E-07	5.2340E-07	-5.4110E-07
	1.7420E-07	5.2690E-07	-5.4510E-07	1.8390E-07	5.3340E-07	-5.4460E-07	1.8710E-07	5.1240E-07	-5.3600E-07
		8.5720E-09	2.1390E-08	1.8090E-08					
4	-3.4770E-08	-1.4900E-07	1.7760E-07	3.4940E-07	7.8330E-07	-8.8270E-07	-3.6110E-08	-1.7370E-07	1.9360E-07
	-3.7750E-08	-1.8740E-07	2.0930E-07	-3.6990E-08	-1.5920E-07	1.6630E-07	-3.7060E-08	-1.1410E-07	1.3620E-07
		1.7550E-08	-1.7130E-08	2.6870E-08					
5	-1.7630E-07	-4.8840E-07	5.2230E-07	7.8330E-07	2.2310E-06	-2.4240E-06	-1.7570E-07	-3.7970E-07	4.5720E-07
	-1.8880E-07	-3.6000E-07	4.3230E-07	-1.2500E-07	-3.2910E-07	4.5040E-07	-1.1710E-07	-5.0730E-07	5.6200E-07
		5.3270E-09	5.2020E-08	-3.2080E-08					
6	1.8610E-07	5.2530E-07	-5.3950E-07	-8.8270E-07	-2.4240E-06	2.8030E-06	1.9070E-07	4.6300E-07	-5.0910E-07
	1.9970E-07	4.4820E-07	-4.9040E-07	1.5910E-07	4.4100E-07	-5.2130E-07	1.4680E-07	5.4670E-07	-5.7650E-07
		3.2330E-09	-8.2190E-09	3.5890E-08					
7	-3.4890E-08	-1.3190E-07	1.7600E-07	-3.6110E-08	-1.7570E-07	1.9070E-07	3.7650E-07	7.9160E-07	-8.9060E-07

-2.9980E-08 -2.0840E-07 2.3050E-07 -5.0410E-08 -1.8530E-07 1.7350E-07 -5.8230E-08 -9.0420E-08 1.2050E-07
 5.9690E-09 -3.5900E-08 5.3290E-08
 8 -1.8490E-07 -5.0640E-07 5.2340E-07 -1.7370E-07 -3.7970E-07 4.6300E-07 7.9160E-07 2.2350E-06 -2.4210E-06
 -2.0440E-07 -3.4020E-07 4.1010E-07 -1.2130E-07 -3.0710E-07 4.4500E-07 -1.0620E-07 -5.3420E-07 5.7960E-07
 5.8430E-09 6.4650E-08 -5.4970E-08
 9 1.9650E-07 5.5190E-07 -5.4110E-07 1.9360E-07 4.5720E-07 -5.0910E-07 -8.9060E-07 -2.4210E-06 2.7890E-06
 2.2080E-07 4.1820E-07 -4.5720E-07 1.5090E-07 4.0700E-07 -5.1270E-07 1.2780E-07 5.8610E-07 -6.0220E-07
 -4.9590E-10 -2.8530E-08 7.0890E-08
 10 -3.5970E-08 -1.0980E-07 1.7420E-07 -3.7750E-08 -1.8880E-07 1.9970E-07 -2.9980E-08 -2.0440E-07 2.2080E-07
 4.2610E-07 7.8190E-07 -8.7720E-07 -6.8660E-08 -2.1910E-07 1.8290E-07 -8.6560E-08 -6.0040E-08 1.0080E-07
 -1.0230E-08 -6.0960E-08 8.8430E-08
 11 -1.9960E-07 -5.4610E-07 5.2690E-07 -1.8740E-07 -3.6000E-07 4.4820E-07 -2.0840E-07 -3.4020E-07 4.1820E-07
 7.8190E-07 2.2610E-06 -2.4440E-06 -1.0790E-07 -2.5510E-07 4.3250E-07 -7.6480E-08 -5.9260E-07 6.1860E-07
 1.2500E-08 9.5580E-08 -1.0620E-07
 12 2.1350E-07 6.0080E-07 -5.4510E-07 2.0930E-07 4.3230E-07 -4.9040E-07 2.3050E-07 4.1010E-07 -4.5720E-07
 -8.7720E-07 -2.4440E-06 2.8060E-06 1.3280E-07 3.4180E-07 -4.9660E-07 8.9320E-08 6.5810E-07 -6.5020E-07
 -1.0300E-08 -6.7550E-08 1.3500E-07
 13 -3.8190E-08 -2.0650E-07 1.8390E-07 -3.6990E-08 -1.2500E-07 1.5910E-07 -5.0410E-08 -1.2130E-07 1.5090E-07
 -6.8660E-08 -1.0790E-07 1.3280E-07 3.2610E-07 7.5670E-07 -8.2070E-07 3.4240E-08 -1.9590E-07 1.9340E-07
 5.3230E-08 4.8570E-08 -6.1560E-08
 14 -1.7290E-07 -5.5170E-07 5.3340E-07 -1.5920E-07 -3.2910E-07 4.4100E-07 -1.8530E-07 -3.0710E-07 4.0700E-07
 -2.1910E-07 -2.5510E-07 3.4180E-07 7.5670E-07 2.2070E-06 -2.3560E-06 -2.1240E-08 -5.9690E-07 6.3190E-07
 5.7390E-08 1.3980E-07 -1.3520E-07
 15 1.6980E-07 5.0770E-07 -5.4460E-07 1.6630E-07 4.5040E-07 -5.2130E-07 1.7350E-07 4.4500E-07 -5.1270E-07
 1.8290E-07 4.3250E-07 -4.9660E-07 -8.2070E-07 -2.3560E-06 2.8150E-06 1.2980E-07 5.2180E-07 -5.7320E-07
 -1.3780E-08 -2.3260E-08 2.4510E-08
 16 -3.8370E-08 -2.5490E-07 1.8710E-07 -3.7060E-08 -1.1710E-07 1.4680E-07 -5.8230E-08 -1.0620E-07 1.2780E-07
 -8.6560E-08 -7.6480E-08 8.9320E-08 3.4240E-08 -2.1240E-08 1.2980E-07 3.5210E-07 5.7640E-07 -6.8240E-07
 7.8670E-08 8.1050E-08 -1.2370E-07
 17 -1.1870E-07 -3.3850E-07 5.1240E-07 -1.1410E-07 -5.0730E-07 5.4670E-07 -9.0420E-08 -5.3420E-07 5.8610E-07
 -6.0040E-08 -5.9260E-07 6.5810E-07 -1.9590E-07 -5.9690E-07 5.2180E-07 5.7640E-07 2.7350E-06 -2.8250E-06
 -3.4730E-08 -1.1700E-07 2.0390E-07
 18 1.3360E-07 4.3400E-07 -5.3600E-07 1.3620E-07 5.6200E-07 -5.7650E-07 1.2050E-07 5.7960E-07 -6.0220E-07
 1.0080E-07 6.1860E-07 -6.5020E-07 1.9340E-07 6.3190E-07 -5.7320E-07 -6.8240E-07 -2.8250E-06 3.1050E-06
 1.2530E-08 1.0610E-07 -1.1730E-07
 19 2.1470E-08 -4.6290E-08 8.5720E-09 1.7550E-08 5.3270E-09 3.2330E-09 5.9690E-09 5.8430E-09 -4.9590E-10
 -1.0230E-08 1.2500E-08 -1.0300E-08 5.3230E-08 5.7390E-08 -1.3780E-08 7.8670E-08 -3.4730E-08 1.2530E-08
 2.2110E-06 5.1940E-06 -5.8270E-06
 20 -1.5860E-08 -6.8440E-08 2.1390E-08 -1.7130E-08 5.2020E-08 -8.2190E-09 -3.5900E-08 6.4650E-08 -2.8530E-08
 -6.0960E-08 9.5580E-08 -6.7550E-08 4.8570E-08 1.3980E-07 -2.3260E-08 8.1050E-08 -1.1700E-07 1.0610E-07
 5.1940E-06 1.5040E-05 -1.6210E-05
 21 1.6650E-08 1.2440E-07 1.8090E-08 2.6870E-08 -3.2080E-08 3.5890E-08 5.3290E-08 -5.4970E-08 7.0890E-08
 8.8430E-08 -1.0620E-07 1.3500E-07 -6.1560E-08 -1.3520E-07 2.4510E-08 -1.2370E-07 2.0390E-07 -1.1730E-07
 -5.8270E-06 -1.6210E-05 1.8630E-05

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

0.0000022110	0.0000051940	-0.0000058270
0.0000051940	0.0000150400	-0.0000162100
-0.0000058270	-0.0000162100	0.0000186300

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

```

0.0000004012 -0.0000000736 -0.0000010644
-0.0000000736 0.0000005241 0.0000006879
-0.0000010644 0.0000006879 0.0000349557
    
```

Horizontal network accuracy = 0.00167 meters.
 Vertical network accuracy = 0.01159 meters.

		Vectors		
To	From	X	Y	Z
wysh	0185	-11515.044	-56590.746	-57030.490
bil5	0185	-57275.507	55221.356	34115.537
mtei	0185	-107447.671	52855.591	16782.722
p722	0185	-186655.669	55600.536	-5363.561
p052	0185	48233.051	140972.587	141174.799
p054	0185	204758.841	-31534.789	24617.073

Covariance matrix of the 6 vectors

```

1 2.5172E-06 6.1084E-06 -6.7517E-06 2.1372E-06 5.0282E-06 -5.6608E-06 2.1487E-06 5.0191E-06 -5.6467E-06
2.1638E-06 4.9978E-06 -5.6199E-06 2.0981E-06 4.9796E-06 -5.6601E-06 2.0725E-06 5.1259E-06 -5.7226E-06
2 6.1084E-06 1.7774E-05 -1.8975E-05 5.1084E-06 1.4568E-05 -1.5801E-05 5.1443E-06 1.4537E-05 -1.5754E-05
5.1915E-06 1.4467E-05 -1.5666E-05 4.9852E-06 1.4417E-05 -1.5803E-05 4.9043E-06 1.4887E-05 -1.6006E-05
3 -6.7517E-06 -1.8975E-05 2.1467E-05 -5.6848E-06 -1.5677E-05 1.8037E-05 -5.7129E-06 -1.5653E-05 1.8000E-05
-5.7498E-06 -1.5598E-05 1.7932E-05 -5.5901E-06 -1.5563E-05 1.8043E-05 -5.5248E-06 -1.5923E-05 1.8193E-05
4 2.1372E-06 5.1084E-06 -5.6848E-06 2.5253E-06 5.9891E-06 -6.7398E-06 2.1514E-06 5.0316E-06 -5.6598E-06
2.1659E-06 5.0112E-06 -5.6343E-06 2.1032E-06 4.9945E-06 -5.6738E-06 2.0777E-06 5.1318E-06 -5.7302E-06
5 5.0282E-06 1.4568E-05 -1.5677E-05 5.9891E-06 1.7167E-05 -1.8594E-05 5.0489E-06 1.4544E-05 -1.5692E-05
5.0608E-06 1.4532E-05 -1.5678E-05 5.0151E-06 1.4519E-05 -1.5704E-05 4.9905E-06 1.4598E-05 -1.5722E-05
6 -5.6608E-06 -1.5801E-05 1.8037E-05 -6.7398E-06 -1.8594E-05 2.1361E-05 -5.6928E-06 -1.5684E-05 1.8014E-05
-5.7190E-06 -1.5647E-05 1.7969E-05 -5.6096E-06 -1.5626E-05 1.8048E-05 -5.5597E-06 -1.5859E-05 1.8135E-05
7 2.1487E-06 5.1443E-06 -5.7129E-06 2.1514E-06 5.0489E-06 -5.6928E-06 2.5756E-06 6.0157E-06 -6.7704E-06
2.1853E-06 5.0090E-06 -5.6395E-06 2.1014E-06 4.9872E-06 -5.6930E-06 2.0681E-06 5.1742E-06 -5.7723E-06
8 5.0191E-06 1.4537E-05 -1.5653E-05 5.0316E-06 1.4544E-05 -1.5684E-05 6.0157E-06 1.7146E-05 -1.8547E-05
5.0447E-06 1.4540E-05 -1.5677E-05 5.0183E-06 1.4528E-05 -1.5687E-05 5.0009E-06 1.4558E-05 -1.5682E-05
9 -5.6467E-06 -1.5754E-05 1.8000E-05 -5.6598E-06 -1.5692E-05 1.8014E-05 -6.7704E-06 -1.8547E-05 2.1277E-05
-5.6941E-06 -1.5657E-05 1.7967E-05 -5.6140E-06 -1.5639E-05 1.8022E-05 -5.5750E-06 -1.5799E-05 1.8074E-05
10 2.1638E-06 5.1915E-06 -5.7498E-06 2.1659E-06 5.0608E-06 -5.7190E-06 2.1853E-06 5.0447E-06 -5.6941E-06
2.6576E-06 6.0244E-06 -6.7823E-06 2.0993E-06 4.9785E-06 -5.7188E-06 2.0560E-06 5.2296E-06 -5.8272E-06
11 4.9978E-06 1.4467E-05 -1.5598E-05 5.0112E-06 1.4532E-05 -1.5647E-05 5.0090E-06 1.4540E-05 -1.5657E-05
6.0244E-06 1.7110E-05 -1.8480E-05 5.0250E-06 1.4550E-05 -1.5648E-05 5.0240E-06 1.4469E-05 -1.5591E-05
12 -5.6199E-06 -1.5666E-05 1.7932E-05 -5.6343E-06 -1.5678E-05 1.7969E-05 -5.6395E-06 -1.5677E-05 1.7967E-05
-6.7823E-06 -1.8480E-05 2.1166E-05 -5.6223E-06 -1.5665E-05 1.7974E-05 -5.6037E-06 -1.5688E-05 1.7962E-05
13 2.0981E-06 4.9852E-06 -5.5901E-06 2.1032E-06 5.0151E-06 -5.6096E-06 2.1014E-06 5.0183E-06 -5.6140E-06
2.0993E-06 5.0250E-06 -5.6223E-06 2.4306E-06 5.8447E-06 -6.5724E-06 2.1133E-06 4.9843E-06 -5.5846E-06
14 4.9796E-06 1.4417E-05 -1.5563E-05 4.9945E-06 1.4519E-05 -1.5626E-05 4.9872E-06 1.4528E-05 -1.5639E-05
4.9785E-06 1.4550E-05 -1.5665E-05 5.8447E-06 1.6967E-05 -1.8408E-05 5.0343E-06 1.4420E-05 -1.5549E-05
15 -5.6601E-06 -1.5803E-05 1.8043E-05 -5.6738E-06 -1.5704E-05 1.8048E-05 -5.6930E-06 -1.5687E-05 1.8022E-05
-5.7188E-06 -1.5648E-05 1.7974E-05 -6.5724E-06 -1.8408E-05 2.1396E-05 -5.5597E-06 -1.5869E-05 1.8150E-05
16 2.0725E-06 4.9043E-06 -5.5248E-06 2.0777E-06 4.9905E-06 -5.5597E-06 2.0681E-06 5.0009E-06 -5.5750E-06
2.0560E-06 5.0240E-06 -5.6037E-06 2.1133E-06 5.0343E-06 -5.5597E-06 2.4058E-06 5.7241E-06 -6.3982E-06
17 5.1259E-06 1.4887E-05 -1.5923E-05 5.1318E-06 1.4598E-05 -1.5859E-05 5.1742E-06 1.4558E-05 -1.5799E-05
    
```

5.2296E-06 1.4469E-05 -1.5688E-05 4.9843E-06 1.4420E-05 -1.5869E-05 5.7241E-06 1.8009E-05 -1.9345E-05
 18 -5.7226E-06 -1.6006E-05 1.8193E-05 -5.7302E-06 -1.5722E-05 1.8135E-05 -5.7723E-06 -1.5682E-05 1.8074E-05
 -5.8272E-06 -1.5591E-05 1.7962E-05 -5.5846E-06 -1.5549E-05 1.8150E-05 -6.3982E-06 -1.9345E-05 2.1970E-05

Correlation matrix of the 6 vectors

1 1.0000E+00 9.1324E-01 -9.1849E-01 8.4769E-01 7.6492E-01 -7.7198E-01 8.4388E-01 7.6400E-01 -7.7158E-01
 8.3660E-01 7.6155E-01 -7.6993E-01 8.4823E-01 7.6195E-01 -7.7126E-01 8.4219E-01 7.6132E-01 -7.6953E-01
 2 9.1324E-01 1.0000E+00 -9.7141E-01 7.6250E-01 8.3399E-01 -8.1092E-01 7.6032E-01 8.3276E-01 -8.1011E-01
 7.5536E-01 8.2958E-01 -8.0770E-01 7.5846E-01 8.3018E-01 -8.1039E-01 7.5000E-01 8.3209E-01 -8.1002E-01
 3 -9.1849E-01 -9.7141E-01 1.0000E+00 -7.7211E-01 -8.1664E-01 8.4228E-01 -7.6831E-01 -8.1590E-01 8.4223E-01
 -7.6125E-01 -8.1390E-01 8.4124E-01 -7.7388E-01 -8.1545E-01 8.4189E-01 -7.6878E-01 -8.0983E-01 8.3775E-01
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 7.4926E-01 8.4794E-01 -8.2248E-01 7.7638E-01 8.5072E-01 -8.1942E-01 7.7656E-01 8.3022E-01 -8.0956E-01
 6 -7.7198E-01 -8.1092E-01 8.4228E-01 -9.1765E-01 -9.7097E-01 1.0000E+00 -7.6750E-01 -8.1952E-01 8.4497E-01
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 8.2600E-01 7.7921E-01 -7.8386E-01 1.0000E+00 9.1012E-01 -9.1137E-01 8.7394E-01 7.5335E-01 -7.6422E-01
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G-FILE for the vectors

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D 16 17 8696304 16 18 -8800809 17 18 -9725520
    
```

ITRF position of 0185 as determined by individual baselines

	X	Y	Z
wysh	-1314881.388	-4279167.136	4529534.700
bil5	-1314881.378	-4279167.140	4529534.687
mtei	-1314881.385	-4279167.164	4529534.698
p722	-1314881.387	-4279167.141	4529534.694
p052	-1314881.393	-4279167.167	4529534.703
p054	-1314881.384	-4279167.148	4529534.695

Residuals of position determined by individual baselines from the final position

	X	Y	Z	East	North	Up
wysh	-0.003	0.010	0.007	-0.006	0.011	-0.001
bil5	0.007	0.006	-0.005	0.005	0.002	-0.009
mtei	0.000	-0.018	0.005	0.006	-0.008	0.016
p722	-0.002	0.005	0.002	-0.003	0.004	-0.001
p052	-0.008	-0.021	0.011	-0.001	-0.008	0.023

p054 0.001 -0.002 0.003 0.001 0.001 0.003

STATE PLANE COORDINATES - International Foot

SPC (2500 MT)

Northing (Y) [feet] 475916.217
Easting (X) [feet] 2588238.593
Convergence [degrees] 1.76960174
Point Scale 0.99972369
Combined Factor 0.99954566

** 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: 1149.879 (m) [PROTOTYPE (Computed using USGG2012,GRS80,IGS08)]

dop from interpolation is 0.464
scatter (mean square distance from rover) is 25379.644
average edop for rover is 0.720
average ndop for rover is 0.890
average hdop for rover is 1.145
average vdop for rover is 2.370
average gdop for rover is 3.060

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.