DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Cape Canaveral, FL DGPS Site (809)
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REFERENCES

(1) Broadcast Standard for the USCG DGPS Navigation Service, CIM 16577.1 (APR 1993).
(2) Radio Technical Commission for Maritime Services (RTCM) Recommended Standards for Differential Global Navigation Satellite System (GNSS) Service, Version 2.3.
(3) Differential Global Positioning System (DGPS) Concept of Operations, COMDTINST 16577.2 (AUG 1995).
(4) 2014 Federal Radio Navigation Plan.

PURPOSE

- Validate advertised DGPS coverage of the Cape Canaveral DGPS site.
- Validate required RTCM message scheduling and delivery.
- Test differential correction accuracy versus a predetermined survey monument.

EQUIPMENT

Trimble SPS461 Receiver
Trimble GA 530 Antenna
Dell Latitude E3620 Laptop

CAPE CANAVERAL DGPS SITE PARAMETERS

Frequency	289 KHz
Forward Output Power	1500 W
Transmission Rate	100 baud
Field Strength/Range	75µV/m (37.5 dBµV/m) at 371 km

SUMMARY

The Operational Assessment of the Cape Canaveral Differential Global Positioning System (DGPS) site revealed that the provided coverage was consistent with the predicted coverage area, but not the advertised range. The signal strength measurements, within the advertised range were satisfactory, with the exception of some terrestrial masking to the northwest. The northwestern far-field signal strength readings were within the required signal strength. Additionally, a review of the output/reflected power and near-field signal strength levels was conducted and found to be satisfactory. All RTCM messages were verified, evaluated and are consistent with the requirements set forth by Reference (1) and (2). Finally, accuracy measurements and analysis proved that at a distance of approximately 344 km from the broadcast site, the horizontal accuracy is sub-meter and within the 10 meter accuracy requirement as set forth by Reference (3) and (4).

RESULTS

Signal Strength

A verification of the DGPS coverage area was conducted from Panama City, FL, around the Florida peninsula, and ending in Jacksonville FL. The advertised signal strength range is 371 km. Figure 1 below displays adequate signal strength throughout the predicted coverage area and the majority of the advertised range. Green points represent areas of signal strength above 40dBµV/m, whereas areas above 37.5 dBµV/m are represented with orange points. Areas where a DGPS fix was unable to be obtained are represented in red. As seen in the Table 1, a far-field signal strength reading was taken at a northwestern point of the advertised range from both sides of the site. The reading was not above the required 37.5 dBµV/m signal strength on both sides, but a DGPS fix was still able to be attained.

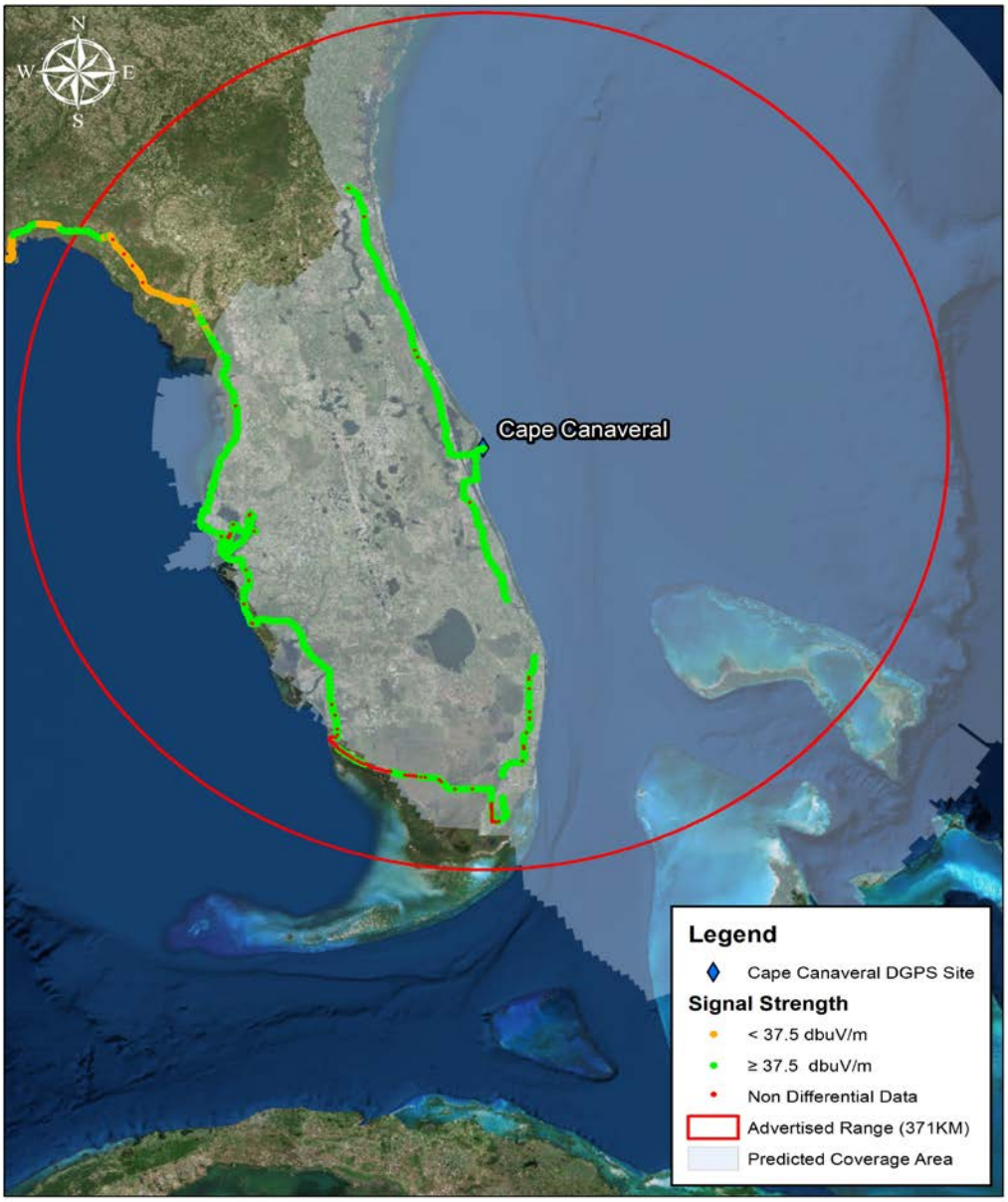

Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	30 dBµV/m	13 dBµV/m	30° 4’ 26.019 ”N, 83°34’ 43.818”W
B	30 dBµV/m	13 dBµV/m	

Table 1: North Far-Field Signal Strength Reading

Accuracy Validation

Positional data was collected for 10 minutes per side using the Trimble SPS461. The data was then post processed and compared to a National Geodetic Survey (NGS) marker to verify the horizontal accuracy of the broadcast correction (Table 4 and 5). Side A was 0.4071 meters, bearing 111.490833º from the monument while Side B was 0.6137 meters, bearing 263.622222º from the monument. As per Reference (3) and (4), both respective distances were within advertised accuracy requirements. A comparison between the GPS satellites in view at the Cape Canaveral DGPS site and at the NGS monument location was conducted (Table 6) to identify any differences in the GPS satellite geometry used at the respective locations; any differences in geometry could lead to accuracy discrepancies. In this case, the satellites being tracked by the Reference Station and Integrity Monitor GPS receivers at the site were not similar to those tracked at the NGS monument location. A two dimension radial review of the same time period was completed for the integrity monitors. Side A’s average deviation was 0.08563 meters; Side B’s average deviation was 0.08154 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	**BD2713**
Monument LAT:	30º 4’ 26.01903” N
Monument LON:	083º 34’ 43.81779 ” W
Distance from DGPS Site	344 km

Table 3: NGS Monument ID

Averaged LAT:	30º 04’ 26.014202” N
Averaged LON:	083º 34‘ 43.803620” W
Distance from Monument:	0.4071 m (1.335627 ft)
Bearing from Monument:	111.490833º

Table 4: Side A Accuracy Check Results

Averaged LAT:	30º 04’ 26.016823” N
Averaged LON:	083º 34’ 43.840607” W
Distance from Monument:	0.6137 m (2.013447 ft)
Bearing from Monument:	263.622222º

Table 5: Side B Accuracy Check Results

Antenna Location	***GPS Satellites Tracked (PRN)***										
Reference Station A	3	6	9	14	15	18	21	22	27	29	
Integrity Monitor A	3	6	9	14	15	18	21	22	27	29	
Reference Station B	3	6	9	14	15	18	21	22	27		
Integrity Monitor B	9	14	15	18	21	22	27				
NGS Monument Location, Side A	1	7	8	11	13	17	28	30			
NGS Monument Location, Side B	1	7	8	11	13	17	28	30			

Table 6: GPS Satellite Comparison

RECOMMENDATION

No changes recommended.

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