



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: English Turn, LA DGPS Site (814)
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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 English Turn 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

ENGLISH TURN DGPS SITE PARAMETERS

Frequency	293 KHz
Forward Output Power	700 W
Transmission Rate	200 BPS
Field Strength/Range	100 μ V/m (40 dB μ V/m) at 315 km

SUMMARY

The Operational Assessment of the English Turn Differential Global Positioning System (DGPS) site revealed that the provided coverage is limited to the northern section of the advertised range. The signal strength measurements, within the advertised range were satisfactory. Both northern and southern 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 121km 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 English Turn DGPS coverage area was conducted from Jackson, MS, along the Mississippi River to Venice, LA; then continued along the Gulf Coast from New Orleans, LA to Mobile Bay, AL, then turning north along the Alabama River. The advertised signal strength range is 315 km. Figure 1 below displays adequate signal strength throughout most of the predicted coverage area; northern portions along the Mississippi River fell below 40 dB μ V/m. Green points represent areas of signal strength above 40 dB μ V/m, whereas areas below 40 dB μ V/m are represented in yellow. Areas where a DGPS fix was unable to be obtained are represented in red. As seen in Table 1 and Table 2, far-field signal strength readings were taken at northern and southern points of the predicted range from both sides of the site. Both northern and southern far-field readings were at or above the required 40 dB μ V/m signal strength on both sides.

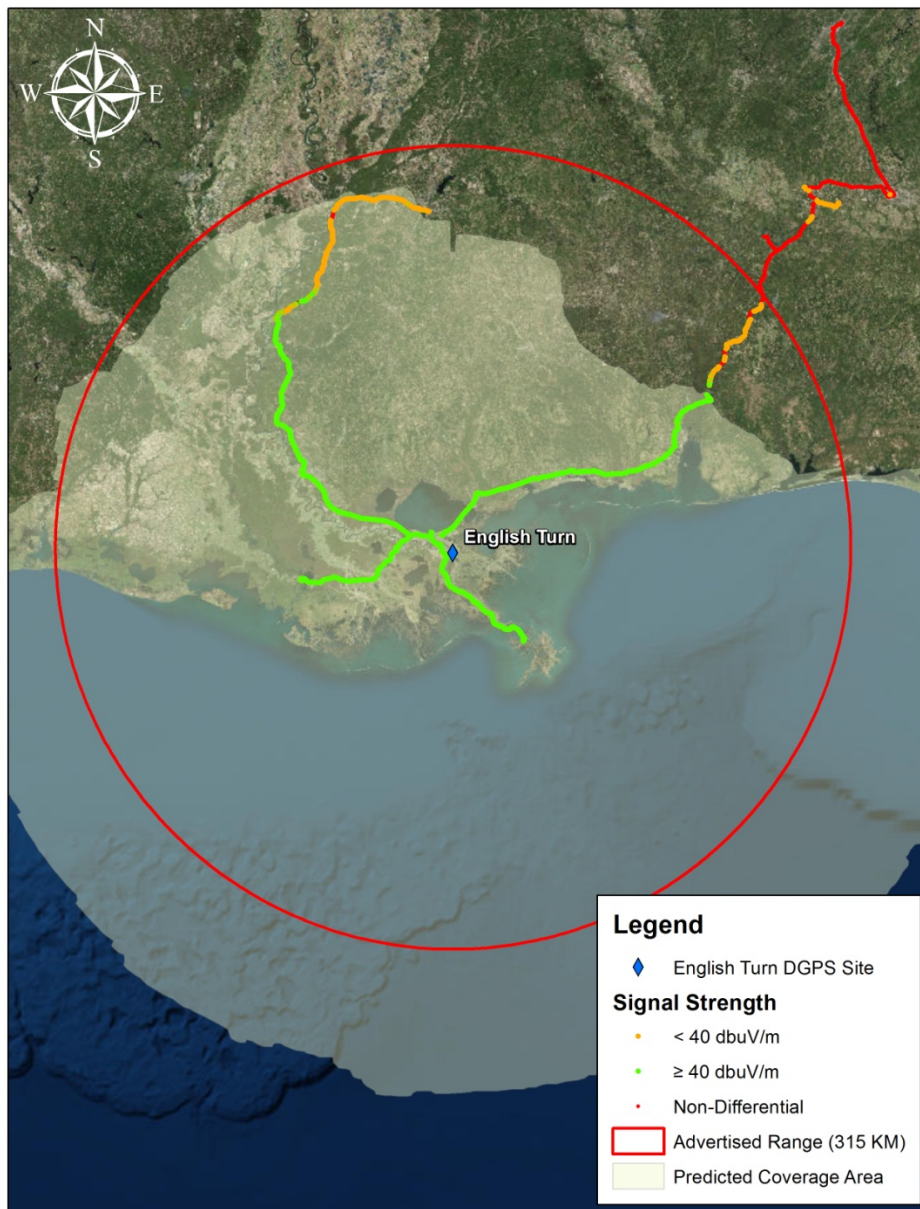


Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	40 dB μ V/m	12 dB μ V/m	31° 04' 55.10"N, 087° 50' 00.60"W
B	40 dB μ V/m	13 dB μ V/m	

Table 1: North Far-Field Signal Strength Reading

Side	Signal Strength	Signal to Noise ratio	Position
A	55 dB μ V/m	25 dB μ V/m	29° 15' 13.10"N, 089° 21' 31.10"W
B	55 dB μ V/m	24 dB μ V/m	

Table 2: South Far-Field Signal Strength Reading

Accuracy Validation

Positional data was collected for 15 minutes per side using the Trimble SPS461 on 8 November 2016. 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 0.6353 meters, bearing 357.58° from the monument while Side B was 0.3939 m meters, bearing 253.83° 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 English Turn 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 included 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 0.41860 meters; Side B's average deviation was 0.42036 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	BBBB18
Monument LAT:	29° 41' 0.12655" N
Monument LON:	091° 10' 33.42790" W
Distance from DGPS Site	121km

Table 3: NGS Monument ID

Averaged LAT:	29° 41' 00.1471" N
Averaged LON:	091° 10' 33.4289" W
Averaged HDOP:	1.0
Distance from Monument:	0.6353 m (2.0843 ft)
Bearing from Monument:	357.58°

Table 4: Side A Accuracy Check Results

Averaged LAT:	29° 41' 00.1230" N
Averaged LON:	091° 10' 33.4420" W
Averaged HDOP:	1.0
Distance from Monument:	0.3939 m (1.2923 ft)
Bearing from Monument:	253.83°

Table 5: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	8	10	12	14	18	20	21	24	27	31	32
Integrity Monitor A	8/10	12	14	18	20	21	24	25	27	31	32
Reference Station B	8/10	12	14	18	20	21	24	25	27	31	32
Integrity Monitor B	8/10	12	14	18	20	21	24	25	27	31	32
NGS Monument Location, Side A	10	14	18	20	21	24	27	31	32		
NGS Monument Location, Side B	10	14	18	21	24	27	31	32			

Table 6: GPS Satellite Comparison

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