



## **DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT**

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**NDGPS Site:** Eglin DGPS Site (812)  
**Inspector(s):** LTJG Dave Stiles, CWO3 William Iozzino  
**Date:** 13FEB2013

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### **REFERENCES:**

- (1) DGPS Concept of Operations, COMDTINST 16577.2 (AUG 1995)
- (2) 2010 Federal Radio Navigation Plan
- (3) Broadcast Standard for the USCG DGPS Navigation Service, CIM 16577.1 (APR 1993).
- (4) RTCM Recommend Standards for Differential GNSS Service, Version 2.3.

### **PURPOSE:**

- Validate advertised DGPS coverage of the Eglin 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  
Potomac Instruments 4100 FIM meter

### **EGLIN DGPS SITE PARAMETERS:**

Frequency	295 kHz
Forward Output Power	1500 W
Transmission Rate	100 baud
Field Strength/Range	75 $\mu$ V/m (37.5 dB $\mu$ V/m) at 144 km

### **RESULTS:**

#### ***Signal Strength:***

A verification of the Eglin DGPS coverage area was conducted from New Orleans, LA to Tallahassee, FL along the Gulf Coast via I-10 and Highway 98. The advertised signal strength range is 144 km. Figure 1 below displays adequate signal strength, beyond the advertised range of 144 km from the site and throughout the predicted coverage area. Green points represent areas of satisfactory signal strength. Areas of unsatisfactory signal strength are represented with red points. Far-field (FF) signal strength readings were taken at western and eastern points of the advertised range from both sides of the site (Table 1 and Table 2). Both eastern and western FF readings were well above the required 37.5 dB  $\mu$ V/m signal strength on both sides.

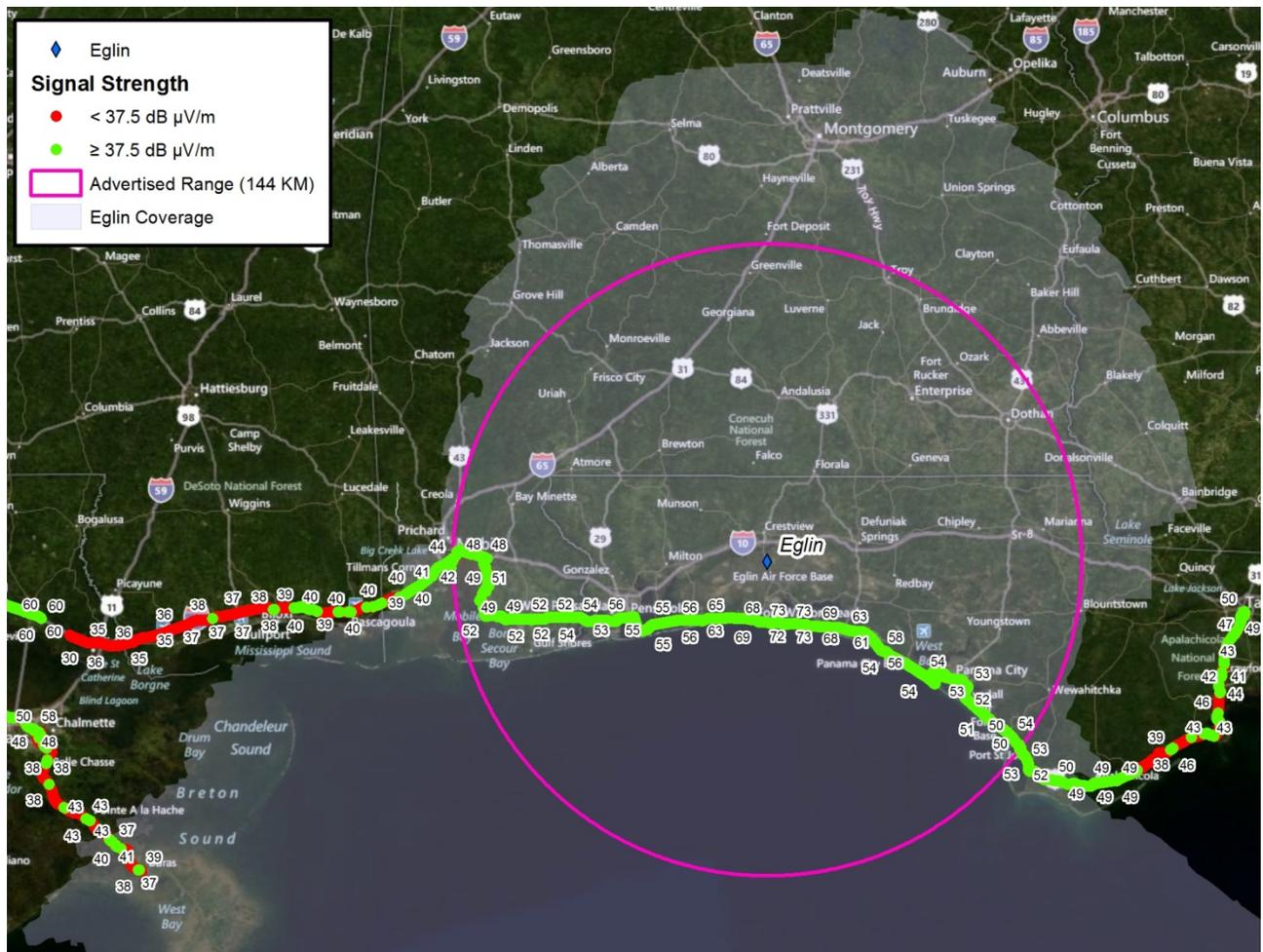


Figure 1: DNAV Signal Strength Results

	POSITION	Trimble SPS461	4100 FIM Meter
Side A SS	30° 38' 59.4" N 088° 03' 41.9" W	38 dB $\mu$ V/m, 8 SNR	38.1 dB $\mu$ V/m
Side B SS	30° 38' 59.4" N 088° 03' 41.9" W	39 dB $\mu$ V/m, 8 SNR	38.5 dB $\mu$ V/m

Table 1: West Far-Field Signal Strength Reading

	POSITION	Trimble SPS461	4100 FIM Meter
Side A SS	29.873734° N 085.339826° W	45 dB $\mu$ V/m, 24 SNR	45 dB $\mu$ V/m
Side B SS	29.873734° N 085.339826° W	46 dB $\mu$ V/m, 19 SNR	44.7 dB $\mu$ V/m

Table 2: East Far-Field Signal Strength Reading

***RTCM Message Verification:***

RTCM message scheduling, receipt, and content were checked during the assessment (Table 3 and 4). RTCM message scheduling on both Side A and Side B was validated with the DGPS watch and is in accordance with the Reference (3). Receipt of all RTCM messages was validated utilizing a Remote Desktop Session whereby the assessment team witnessed the on-time receipt of all messages on the active Integrity Monitor computer. All message content was verified and is in accordance with Reference (4).

<b>Message Type</b>	<b>Received</b>	<b>Scheduled</b>	<b>Content Verified/Accurate</b>
<i>Type 3</i>	Y	Y	Y
<i>Type 5 (ensure message is not being transmitted)</i>	N	N	N/A
<i>Type 7</i>	Y	Y	Y
<i>Type 9</i>	Y	Y	Y
<i>Type 16</i>	Y	Y	Y

Table 3: Side A RTCM Message Validation

<b>Message Type</b>	<b>Received</b>	<b>Scheduled</b>	<b>Content Verified/Accurate</b>
<i>Type 3</i>	Y	Y	Y
<i>Type 5 (ensure message is not being transmitted)</i>	N	N	N/A
<i>Type 7</i>	Y	Y	Y
<i>Type 9</i>	Y	Y	Y
<i>Type 16</i>	Y	Y	Y

Table 4: Side B RTCM Message Validation

**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 5 and 6). Side A was 0.6161 meters, bearing 260.9°, away from the monument while Side B was 0.6376 meters, bearing 207.5°, away from the monument. As per Reference (1) and (2), both respective distances were well within advertised accuracy requirements. A comparison between the GPS satellites in view at the Eglin DGPS site and at the NGS monument location was conducted (Table 7) 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 RS and IM GPS receivers at the site were almost identical to those tracked at the NGS monument location.

<b>NGS Monument ID:</b>	<b>BBCD51</b>
Monument LAT:	30.66826758° N
Monument LON:	087.93621534° W

<b>Averaged LAT:</b>	30.6668267° N
<b>Averaged LON:</b>	087.9362217° W
<b>Distance from DGPS Site:</b>	132.8 km
<b>Antenna Distance from Monument:</b>	0.6161 m (2.0213 ft)
<b>Antenna Bearing from Monument:</b>	260.9°

Table 5: Side A Accuracy Check Results

<b>Averaged LAT:</b>	30.6682693° N
<b>Averaged LON:</b>	087.9362217° W
<b>Distance from DGPS Site:</b>	132.8 km
<b>Distance from Monument:</b>	0.6376 m (2.0918 ft)
<b>Bearing from Monument:</b>	207.5°

Table 6: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	1	11	12	14	18	22	25	30	31	32	
Integrity Monitor A	1	11	12	14	18	22	25	30	31	32	
Reference Station B	1	11	12	14	18	22	25	30	31	32	
Integrity Monitor B	1	11	12	14	18	22	25	30	31	32	
NGS Monument Location, Side A	1	11	12	14	18	22	25	30	31	32	
NGS Monument Location, Side B	1	11	12	14	18	25	30	31	32		

Table 7: GPS Satellite Comparison

**SUMMARY:**

The Operational Assessment of the Eglin DGPS site revealed that the provided coverage is consistent with the predicted coverage plot and advertised range. Both western and eastern Far-Field signal strength readings were well within the required signal strength. The signal strength measurements, throughout the predicted coverage area and within the advertised range, were satisfactory. Additionally, a review of the output/reflected power levels was conducted and found to be satisfactory. All RTCM messages were verified and evaluated and are consistent with the requirements set forth by reference (3) and (4). Finally, accuracy measurements and analysis proved that at a distance of approximately 132.8 km from the broadcast site, the horizontal accuracy is sub-meter and within the accuracy requirements set forth by Reference (1) and (2).