



## VESSEL TRAFFIC SERVICE LOWER MISSISSIPPI RIVER COVERAGE VERIFICATION

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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 Lower Mississippi River (LMR) New Orleans Vessel Traffic Service (VTS) area.

### **EQUIPMENT:**

Trimble SPS461 Receiver  
Trimble GA 530 Antenna  
Potomac Instruments 4100 FIM meter

### **RESULTS:**

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

A verification of DGPS coverage through the VTS LMR area was conducted from 20 miles (32 km) north of the Port of Baton Rouge along the Mississippi River to 65 miles (105 km) south of New Orleans. Figures 1-4 display the DGPS signal strength results provided to the VTS LMR area by the English Turn, Eglin, Bobo, and Angleton DGPS sites, respectively. As per Reference (3), field intensity for a site with a transmission baud rate of 100 should be  $75\mu\text{V/m}$  (37.5 dB), while a site with a transmission baud rate of 200 should be  $100\mu\text{V/m}$  (40 dB); the aforementioned sites have transmission baud rates of 100, with the exception of English turn which has a 200 baud rate. Figure 1 shows the English Turn site provides satisfactory signal strength throughout the entire VTS area, while Figure 2 shows unsatisfactory signal strength from the Eglin site. Figure 3 shows the Bobo site provides adequate signal strength to the northern area of the VTS from the port of Baton Rouge north to the end of the VTS area. Figure 4 shows the Angleton site provides adequate signal strength throughout most of the VTS LMR area, however the western edge of Lake Maurepas marks the maximum useable range of 300 miles (483 km) from the site per Reference (3) and shown in Figure 5. Far-field signal strength readings were taken at northern and southern points of the VTS area. Angleton, Bobo, and English Turn provided adequate signal strength to the northern VTS area (Table 1), while only English Turn provided sufficient signal strength to the southern VTS area (Table 2).

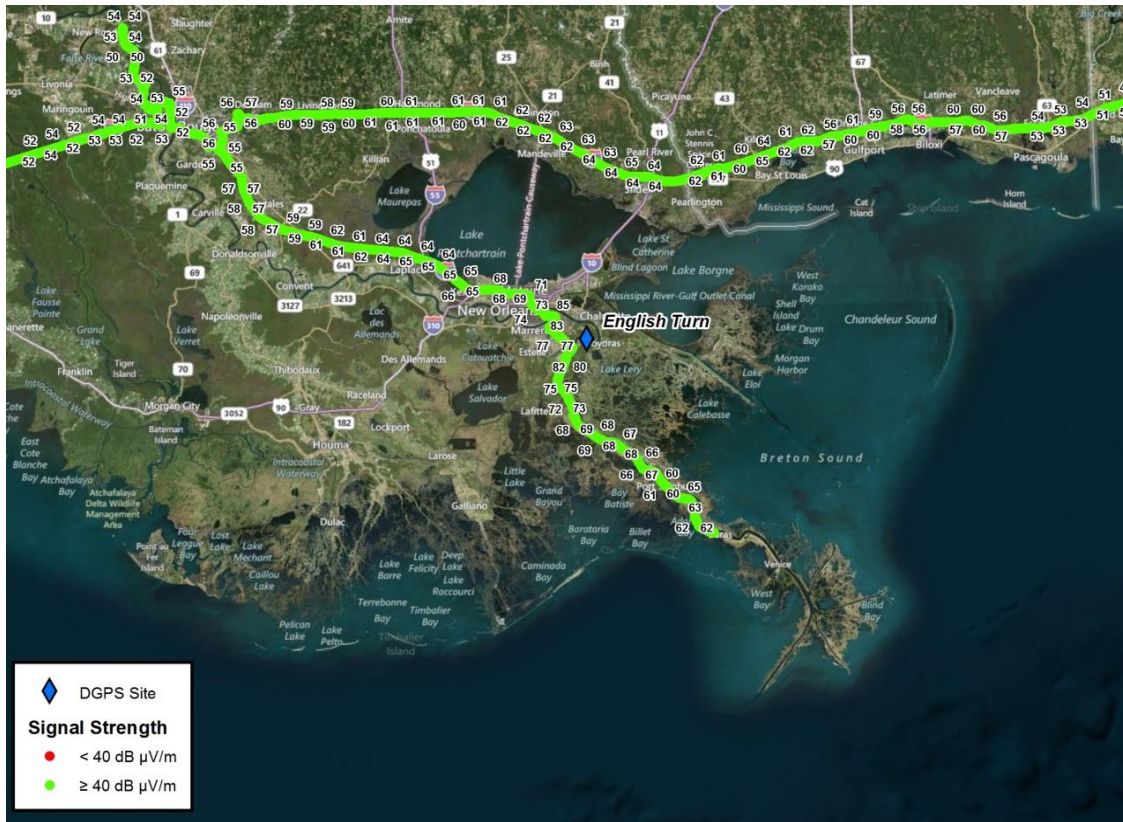


Figure 1 English Turn DGPS Signal Strength VTS LMR

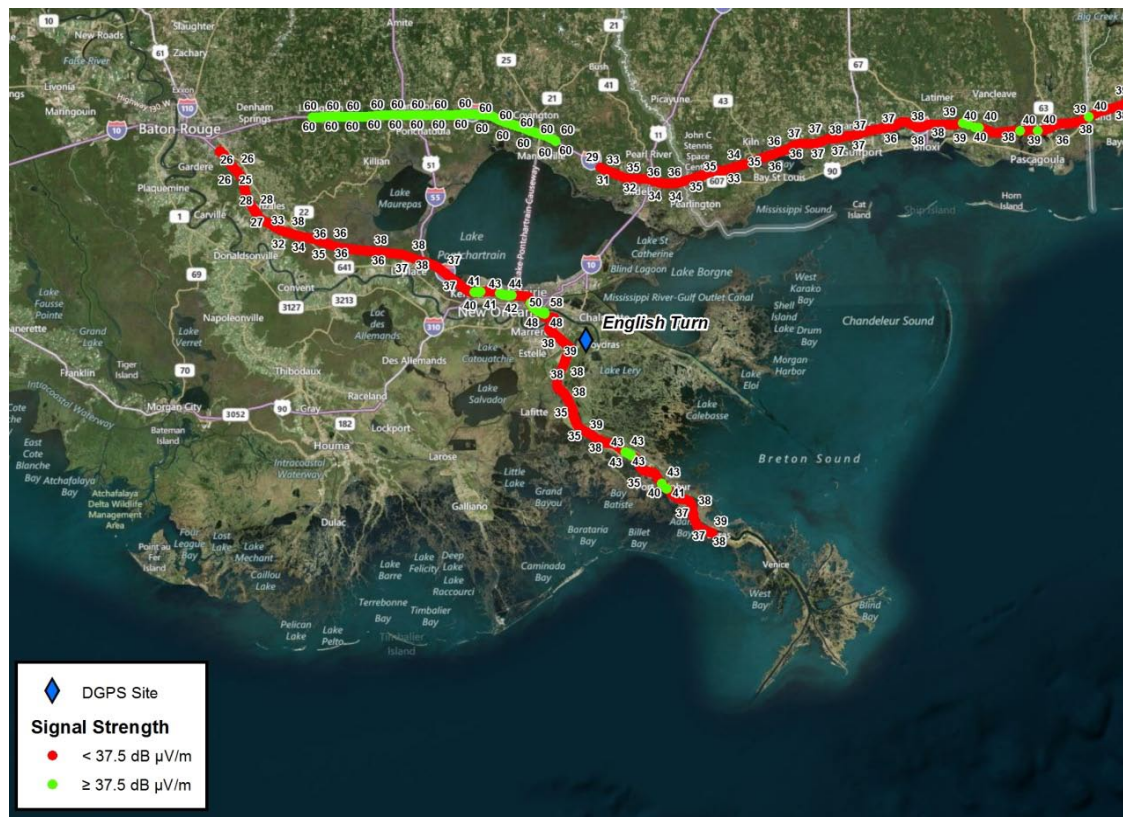


Figure 2 Eglin DGPS Signal Strength VTS LMR



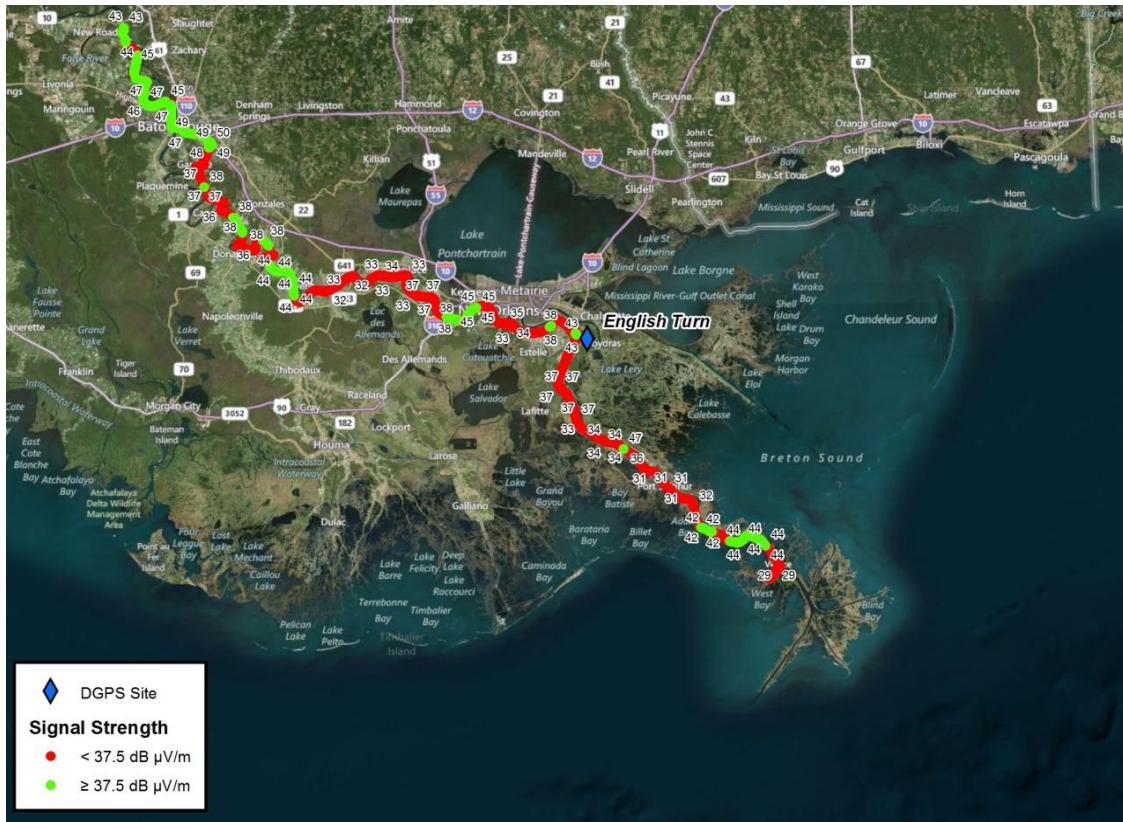


Figure 3 Bobo DGPS Signal Strength VTS LMR

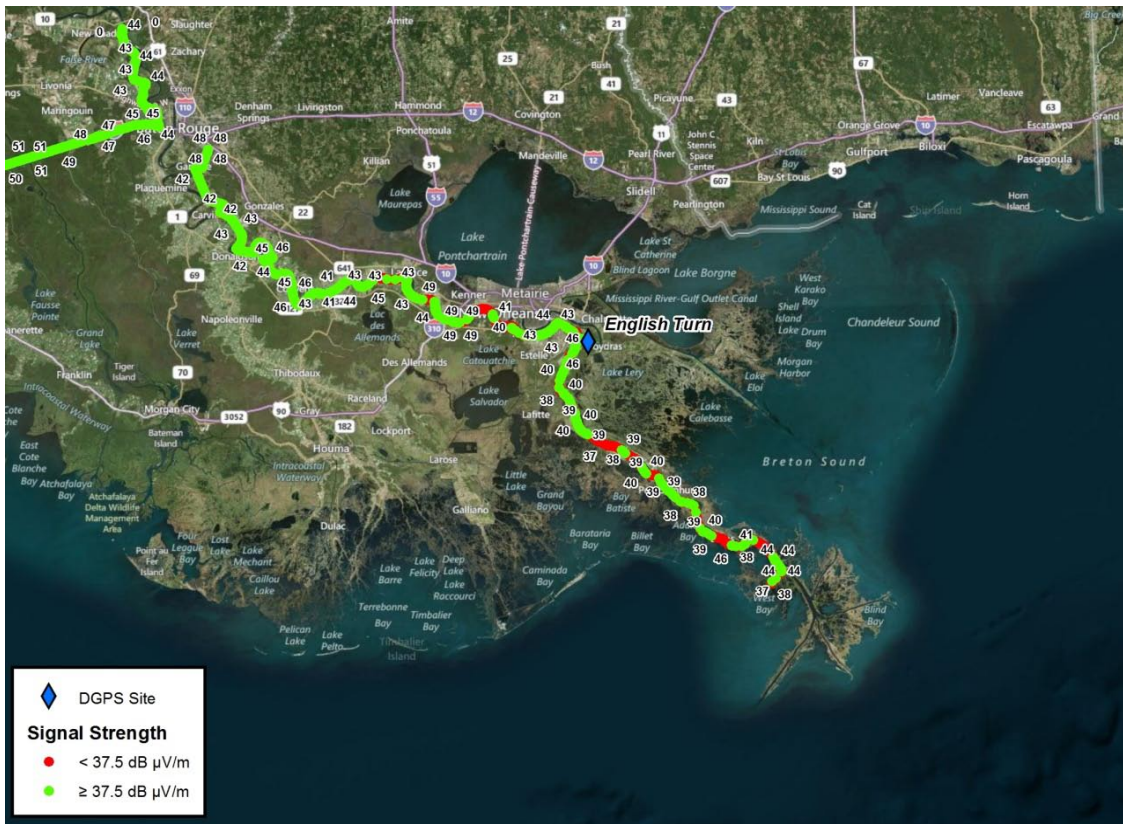


Figure 4 Angleton DGPS Signal Strength VTS LMR



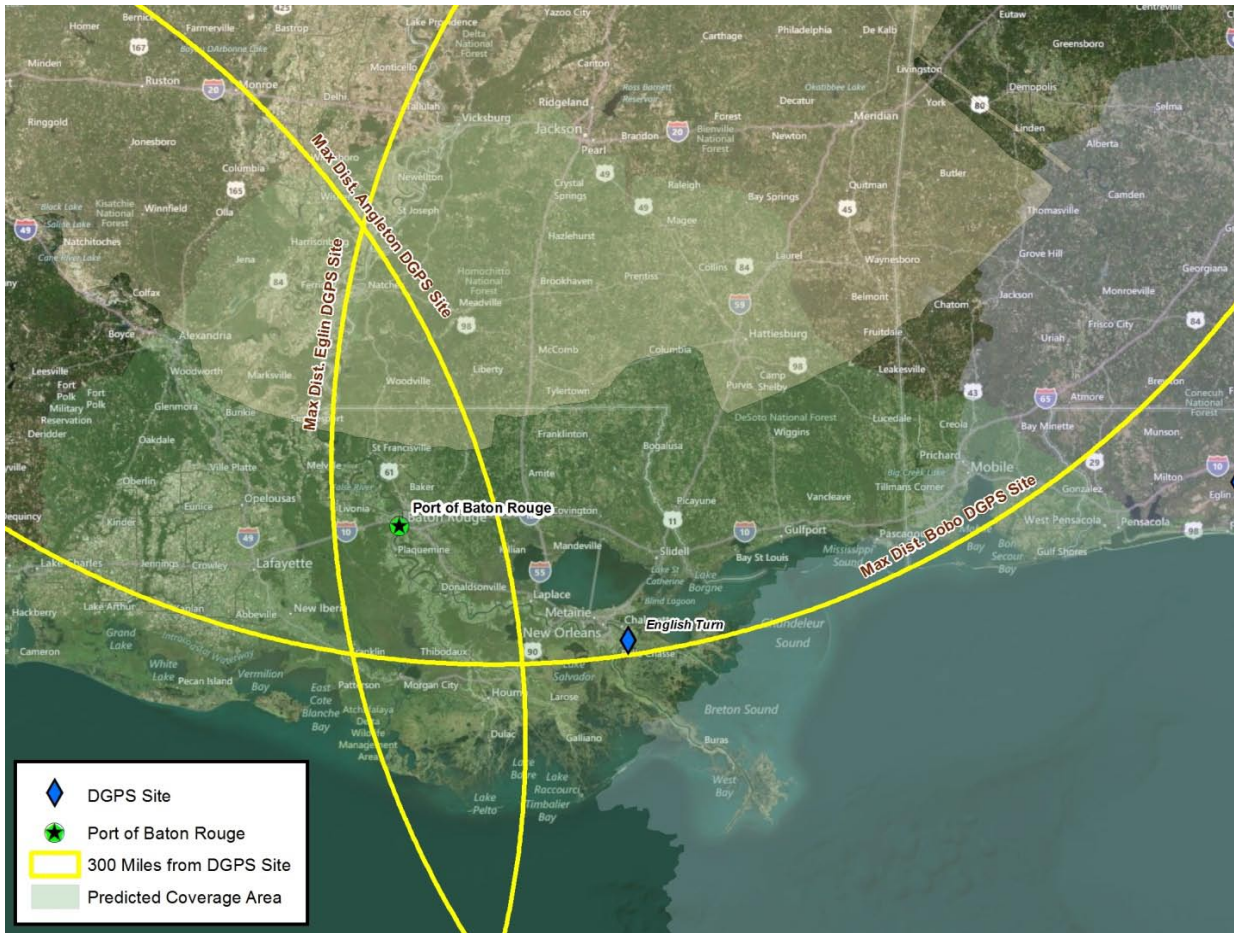


Figure 5 Max Range – Angleton, Bobo, and Eglin

Site	POSITION	Trimble SPS461
English Turn	30° 42' 18.38988"N, 091° 21' 22.248"W	50 dBμV/m, 27 SNR
Angleton	30° 42' 18.38988"N, 091° 21' 22.248"W	39 dBμV/m, 17 SNR
Bobo	30° 42' 18.38988"N, 091° 21' 22.248"W	40 dBμV/m, 19 SNR
Eglin	30° 42' 18.38988"N, 091° 21' 22.248"W	No Signal

Table 1: VTS LMR North Far-Field Signal Strength Reading

	POSITION	Trimble SPS461
English Turn	29° 21' 36.054"N 089° 33' 13.836"W	62 dBμV/m, 27 SNR
Angleton	29° 14' 12.270"N 089° 23' 10.506"W	36 dBμV/m, 14 SNR
Bobo	29° 21' 36.054"N 089° 33' 13.836"W	29 dBμV/m, 02 SNR
Eglin	29° 21' 36.054"N 089° 33' 13.836"W	37 dBμV/m, 22 SNR

Table 2: VTS LMR South 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. Tables 3 through 6 display the accuracy validation for the English Turn DGPS site, located 211 km west of the NGS monument, and the Eglin site, located 133 km east of the NGS monument. Both sites provided sub-meter accuracy with English Turn within 0.36 meters and Eglin within 0.64 m.

<b>NGS Monument ID: BBCD51</b>	30° 40' 05.76330"N, 087° 56' 10.37521"W
<b>Averaged LAT:</b>	30° 40' 05.761200" N
<b>Averaged LON:</b>	087° 56' 10.362120" W
<b>Distance from DGPS Site:</b>	211.4 km
<b>Antenna Distance from Monument:</b>	0.3541m (1.1617ft)
<b>Antenna Bearing from Monument:</b>	100.45°

Table 3: English Turn Side A Accuracy Check Results

<b>NGS Monument ID: BBCD51</b>	30° 40' 05.76330"N, 087° 56' 10.37521"W
<b>Averaged LAT:</b>	30° 40' 05.760840" N
<b>Averaged LON:</b>	087° 56' 10.362120" W
<b>Distance from DGPS Site:</b>	211.4 km
<b>Distance from Monument:</b>	0.3563 m (1.1690 ft)
<b>Bearing from Monument:</b>	102.3°

Table 4: English Turn Side B Accuracy Check Results

<b>NGS Monument ID: BBCD51</b>	30° 40' 05.76330"N, 087° 56' 10.37521"W
<b>Averaged LAT:</b>	30 ° 40' 00.576120"N
<b>Averaged LON:</b>	87 ° 56' 10.398120"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: Eglin Side A Accuracy Check Results

<b>NGS Monument ID: BBCD51</b>	30° 40' 05.76330"N, 087° 56' 10.37521"W
<b>Averaged LAT:</b>	30 ° 40' 05.769480"N
<b>Averaged LON:</b>	87 ° 56' 10.398120"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: Eglin Side B Accuracy Check Results

Accuracy readings were also taken for the Angleton and Bobo DGPS sites at an NGS monument located 105 km northwest of New Orleans (Tables 7 through 9). For both sites, the monument was located outside of the advertised and predicated coverage areas but within the maximum radius of 300 miles, per Reference (3). While performing accuracy checks the Trimble 461 receiver was able to maintain a signal lock and provide a two dimensional DGPS fix for both sites despite the extensive range. The Angleton site, located 451 km west of the NGS monument, provided accuracy of less than 1.85 meters on side B; side A was down for maintenance at the time of the test. The Bobo site, located 406 km north of the NGS monument, provided an accuracy of better than 1.33 m.

<b>NGS Monument ID: BBBH36</b>	30° 28' 34.86154"N, 091° 0' 19.32398"W
<b>Averaged LAT:</b>	30° 28' 34.838760"N,
<b>Averaged LON:</b>	091° 00' 19.260"W
<b>Distance from DGPS Site:</b>	451.4 km
<b>Antenna Distance from Monument:</b>	1.84497 m (6.05' ft)
<b>Antenna Bearing from Monument:</b>	112.4°

Table 7: Angleton Side B Accuracy Check Results

<b>NGS Monument ID: BBBH36</b>	30° 28' 34.86154"N, 091° 0' 19.32398"W
<b>Averaged LAT:</b>	30 28' 34.83120" N
<b>Averaged LON:</b>	091 00' 19.325880" W
<b>Distance from DGPS Site:</b>	406.2 km
<b>Distance from Monument:</b>	0.93567 m (3.0697 ft)
<b>Bearing from Monument:</b>	183.1°

Table 8: Bobo Side A Accuracy Check Results

<b>NGS Monument ID: BBBH36</b>	30° 28' 34.86154"N, 091° 0' 19.32398"W
<b>Averaged LAT:</b>	30° 28' 34.820760" N
<b>Averaged LON:</b>	091° 00' 19.307880" W
<b>Distance from DGPS Site:</b>	406.2 km
<b>Distance from Monument:</b>	1.32736 m (4.3548 ft)
<b>Bearing from Monument:</b>	161.1°

Table 9: Bobo Side B Accuracy Check Results

As per References (1) and (2), all distances were well within advertised accuracy requirements. A comparison between the GPS satellites in view at each site and at the NGS monument locations was also conducted (Tables 10 through 13) to identify any differences in the GPS satellite geometry used at the respective locations; any differences in geometry could lead to positional inaccuracy. In this case, at least 8 satellites were the same at the NGS monument position as the respective site..

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

Table 10: English Turn GPS Satellite Comparison

<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 11: Eglin GPS Satellite Comparison

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>											
Site	2	4	9	15	18	21	22	24	25	26	29	30
NGS Monument	2	5	9	15	18	21	24	25		26	29	30

Table 12: Angleton GPS Satellite Comparison

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>													
Reference Station A	2	5	8	9	15	16	18	21	22	24	25	26	29	30
Reference Station B	2	5	8	9	15	16	18	21		24	25	26	29	30
NGS Monument	2	5		9	15		18	21	22	24		26	29	30

Table 13: Bobo GPS Satellite Comparison

**SUMMARY:**

The Operational Assessment of the VTS LMR area revealed the English Turn, Angleton, and Bobo DGPS sites provide triple coverage from the Port of Baton Rough to the northern edge of the VTS LMR area; readings taken from the Eglin DGPS site show insufficient signal strength throughout the VTS LMR area. The Angleton site provides sufficient signal strength throughout the entire VTS area (Figure 4), but as shown in Figure 5, the eastern portion of the VTS area is outside of the usable DGPS range of 300 miles. Therefore, due to the excessive range for Angleton, the lower portion of the VTS LMR area has only single DGPS coverage provided by the English Turn DGPS site.