Assessment of Autonomous and WAAS Enabled GPS receivers

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BIOGRAPHY

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ABSTRACT

The assessment of GNSS technology in this lab could be useful to all geoscientists. It is important that the GPS receivers perform their best under any condition. The assessment help determines the difference between the collected measurements and the bet fit measurements.

Once a set of data is collected, Microsoft Excel sheets can be utilized to measure the variances. Using the standard deviation formula, Excel can determine how far off the measured distances are from the actual average. This allows geoscientists to take into consideration that the GPS receivers do not collect the exact data at every moment.

In conclusion, every GPS device can only be used to measure the estimated data and are not always accurate. Therefore, geoscientists need to be knowledgeable about how to find the error to take them into account within their calculations.

INTRODUCTION

The purpose of this research is determine the methods to develop a Space Based RTK GPS (SB-RTK) solution. SB-RTK will allow users to communicate to CORS generating NTRIP type solutions. TxSRC investigated the best economic and ergonomic methods to obtain broadband Internet connection via satellite communication. The method and material used to accomplish SB-RTK are discussed. SB-RTK usage by TxSRC for heights determination is the driving force to this research. Description of the technology in broadband satellite internet is provide within the context of this paper as well as an evaluation of the system as it relates to usage by production type surveying GPS. Conclusions are drawn to outline future testing and usage in integration into TxSRC activities.

METHODS.

The system components for this test are typical geodetic GPS receiver capable of utilizing RTK. Figure 1.0 illustrates how the base station GPS communicates to a internet server. A Trimble 5700 receiver with Zepher antenna is connected to Trimble GPSBASE server software. The software is configured to produce NTRIP correction and broadcast, also known as web cast, the correction via that server IP address. In this configuration a local internet provider was tested to determine is proxy IP within a De Militarized Zone (DMZ) firewall. DMZ firewalls all inbound traffic to have access to specific ports and applications. DMZ is less secure because all unassigned firewall ports are open for that computer (Gateway, 2005).

Figure 1.0 Label at the Bottom

Table 1.0 Autonomous Distances Standard Deviation

Measurement	= V	=V²
DIST0- AVG	0.065482493	0.004287957
DIST3- AVG	-0.243839145	0.059457528
DIST6- AVG	0.438568161	0.192342032
DIST9- AVG	-0.018669602	0.000348554
DIST15- AVG	1.000873719	1.001748202
DIST18- AVG	-0.285330749	0.081413636
DIST21- AVG	-0.885984781	0.784969032
DIST24- AVG	-0.305303669	0.09321033
DIST27- AVG	0.82166756	0.675137579
DIST30- AVG	-0.587463993	0.345113943
		$=\sum V^2$ 3.238028794
	Standard Deviation	0.599817453

Table 2.0 WAAS Distances Standard Deviation

Measurement	= V	=V²
DIST0- AVG	0.194869	0.037973931
DIST3- AVG	0.1870717	0.034995807
DIST6- AVG	-0.4749607	0.225587677
DIST9- AVG	0.1068861	0.011424632
DIST15- AVG	-0.6026964	0.363242914
DIST18- AVG	0.2468696	0.060944618
DIST21- AVG	0.6520538	0.425174113
DIST24- AVG	0.0120881	0.000146122
DIST27- AVG	-0.442516	0.195820404
DIST30- AVG	0.1203348	0.014480469
		$=\sum V^2$ 1.369790688
	Standard Deviation	0.390126858

RESULTS

The purpose of this test was for the communication configuration. Therefore, the base and rover were within 30 meters so that any configuration changes could be made. The radio modem option was selected for the test. Radios were not injected, but a straight through COM cable from the PC to the Trimble 5700 GPS was used. This allowed for analysis of latency and communication errors due solely to the broadband internet satellite. A baud rate of 38400 was used and configured with GNSS Internet Radio 1.4.3 and the Trimble 5700 GPS. A standard Trimble COM cable was plugged directly into the receiver with the correction coming from the PC (See Figure 5.0). The satellite antenna was mounted on a pole and placed near Trimble 5700 GPS as seen in Figure 6.0.

CONCLUSION

The range of the cost of the configuration is listed in Table 3.0

Table 3.0 Costs

Option	Description	Cost
1	Robotic Satellite Installation	~ $5,000 - $10,000 (US)
2	Tripod Configuration	~$750 - $1,500 (US)
3	Permanent Pole Configuration	~$500- $600 (US)
Monthly Service Cost	Lowest Data Rate	~$60 - $100 /Mnth (US)

ACKNOWLEDGMENTS

REFERENCES
GARMIN Manual
Reading Assignment

Time	O&M - Autonomous		MSC - Autonomous		
	Lat	Lon	Lat	Lon	Distance (degrees)
0	30.61798	-96.336674	30.611814	-96.340456	44.42074194
3	30.617959	-96.336677	30.611859	-96.340483	44.1114203
6	30.618071	-96.336702	30.611821	-96.340444	44.79382761
9	30.618018	-96.336725	30.611839	-96.340445	44.33658985
12	30.618164	-96.33672	30.611821	-96.340476	45.35613317
15	30.617943	-96.336661	30.611827	-96.340416	44.0699287
18	30.617786	-96.336624	30.611812	-96.340454	43.46927467
21	30.618	-96.3367	30.611888	-96.340456	44.04995578
24	30.618175	-96.336724	30.61184	-96.340426	45.17692701
27	30.617911	-96.336686	30.61184	-96.340422	43.76779545
				Average	44.35525945

Measurement	Variance	Squared Variance	Standard Deviation
Dist 0 - Avg	0.065482493	0.004287957	0.599817453
Dist 3 - Avg	-0.243839145	0.059457528	
Dist 6 - Avg	0.438568161	0.192342032	
Dist 9 - Avg	-0.018669602	0.000348554	
Dist 12 - Avg	1.000873719	1.001748202	
Dist 15 - Avg	-0.285330749	0.081413636	
Dist 18 - Avg	-0.885984781	0.784969032	
Dist 21 - Avg	-0.305303669	0.09321033	
Dist 24 - Avg	0.82166756	0.675137579	
Dist 27 - Avg	-0.587463993	0.345113943	
	Sum	3.238028794	

	O&M - WAAS		MSC - WAAS		
	Lat	Lon	Lat	Lon	Distance (degrees)
0	30.618018	-96.336679	30.61183	-96.340465	477642.2838
3	30.61799	-96.336698	30.611859	-96.340483	477642.276
6	30.61805	-96.336764	30.61181	-96.34042	477641.6139
9	30.617955	-96.336691	30.611844	-96.34043	477642.1958
12	30.618209	-96.336747	30.611827	-96.340481	477641.4862
15	30.617939	-96.336671	30.611842	-96.340428	477642.3358
18	30.617873	-96.336656	30.611827	-96.340448	477642.741
21	30.618	-96.3367	30.611847	-96.340448	477642.101
24	30.618122	-96.336706	30.61184	-96.340429	477641.6464
27	30.617933	-96.336677	30.611836	-96.340401	477642.2092
				average	477642.0889

Measurement	Variance	Squared Variance	Standard Deviation
Dist 0 - Avg	0.194869	0.037973931	0.390126858
Dist 3 - Avg	0.1870717	0.034995807	
Dist 6 - Avg	-0.4749607	0.225587677	
Dist 9 - Avg	0.1068861	0.011424632	
Dist 12 - Avg	-0.6026964	0.363242914	
Dist 15 - Avg	0.2468696	0.060944618	
Dist 18 - Avg	0.6520538	0.425174113	
Dist 21 - Avg	0.0120881	0.000146122	
Dist 24 - Avg	-0.442516	0.195820404	
Dist 27 - Avg	0.1203348	0.014480469	
	Sum	1.369790688	