DRAFT
Performance Testing of the Trimble GeoXT Global Positioning System Receiver

Richard McCullough 11-7-2002

Equipment:

Trimble GeoXT 12-channel receiver, S/N 4236B12265
GeoXT firmware version 1.00
TerraSync Software version 2.20

Test Network and Survey Station Data:

The Ridley Creek State Park GPS Test Network is located in southeastern Pennsylvania, 16 miles west of Philadelphia in Newtown Square. Trimble Navigation established the test site in June 1997 using four, dual frequency, 4000Si survey grade GPS receivers. A Delaware High Accuracy Reference Network (HARN) Order B site and two First Order benchmarks were used to establish two First Order geodetic monuments in an open field at the State Park. The following year, the Natural Resource Conservation Service used a Topcon GTS-4B Total Station to establish ten survey points under the forest canopy. Each point is monumented by a four-foot length of rebar with an aluminum cap.

Click aerial photograph to view Ridley Creek State Park GPS Test Network

The GPS Test Site consists of two polygons with ten turning points under a heavy deciduous canopy dominated by large diameter poplar, hickory, oak and beech. Two Control Points are located in an open field between the polygons. The total Test Site area is 6.23 acres. The site has a southwest aspect with no terrain obstructions above 20 degrees.

Field Data Logging Procedures:

Data Collection Dates: October 3, 2002 – October 22, 2002
Data was collected as individual files on all twelve points, on three separate occasions (252 files)
Foliage Conditions: Generally dry
The current almanac was collected each day before test data was recorded
Max. PDOP: 6.0
Min. SNR: 4.0
Min. Elevation: 15 Degrees
Antenna Height: 1.5 meters
Logging Rate: 1 second
Data Collection: (internal antenna, external antenna, WAAS only) Single Fix, 5 Fixes, 60 Fixes
WAAS: Real-Time Only (no uncorrected fixes)
UTM NAD83, Zone 18

Office Data Processing Procedures:

Trimble GPS Pathfinder Office 2.90
Post-Processing / Base Stations:

CHES CORS Site: 10 miles away, Trimble 5700, Logging Interval=15 seconds, Elevation Mask=10 degrees
http://www.chesco.org/gis/cors/index.html

New Jersey DEP Community Base Station: 40 miles away, Trimble Pathfinder Pro-XR, Logging Interval= 5 seconds, Elevation Mask=5 degrees, Trimble PFCBS software version 2.68
http://www.state.nj.us/dep/gis/

Files (.ssf and .cor) were exported to Microsoft Excel in .dbf format

Test Results:

All test results are illustrated at 95% confidence levels as calculated by the NSSDA method and Trimble Pathfinder Office using the NJDEP base station. Chart 1 and Chart 2 show the raw (.ssf), the differentially corrected (.cor) and WAAS results as calculated by the NSSDA method. Chart 3 and Chart 4 show the results as calculated by Pathfinder Office.

The horizontal accuracy for the corrected data at the open field points was sub-meter using the internal antenna.

Using the external antenna decreased the horizontal accuracy and increased the amount of time to collect the fixes.

“WAAS only” corrections were received at all points, during all sessions, without difficulty.

Post-processing results using the NJDEP base station (40 miles away) were more accurate than the CORS site (10 miles away). May be due to the faster logging rate at the NJDEP site.

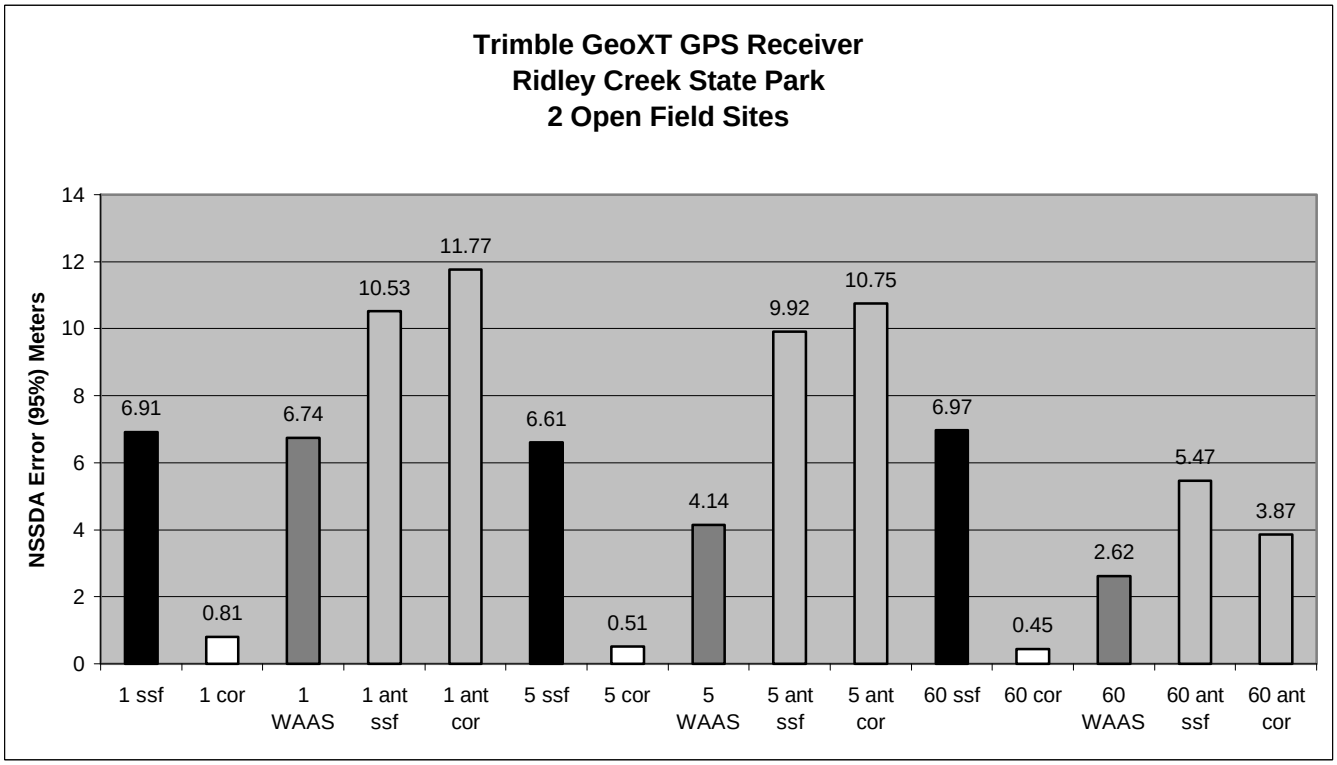


Chart 1.

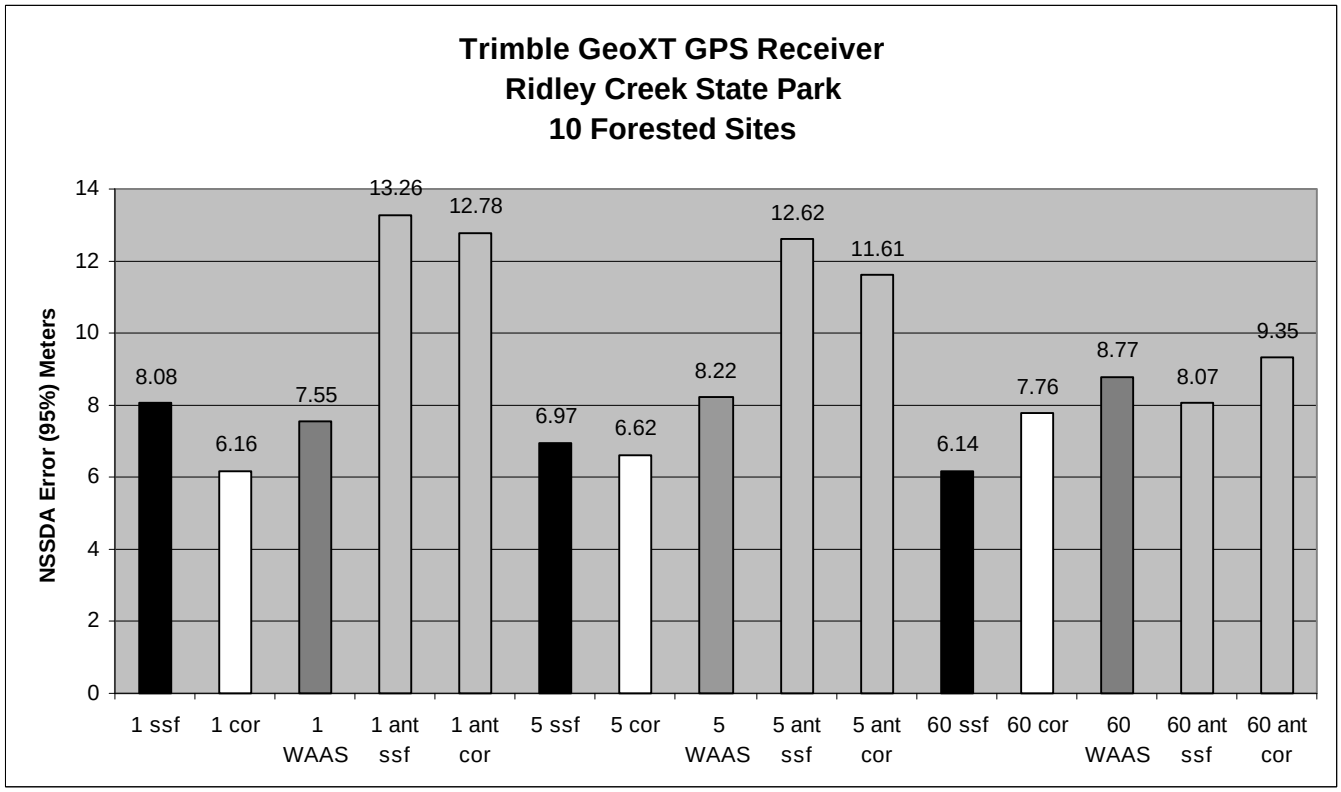


Chart 2.

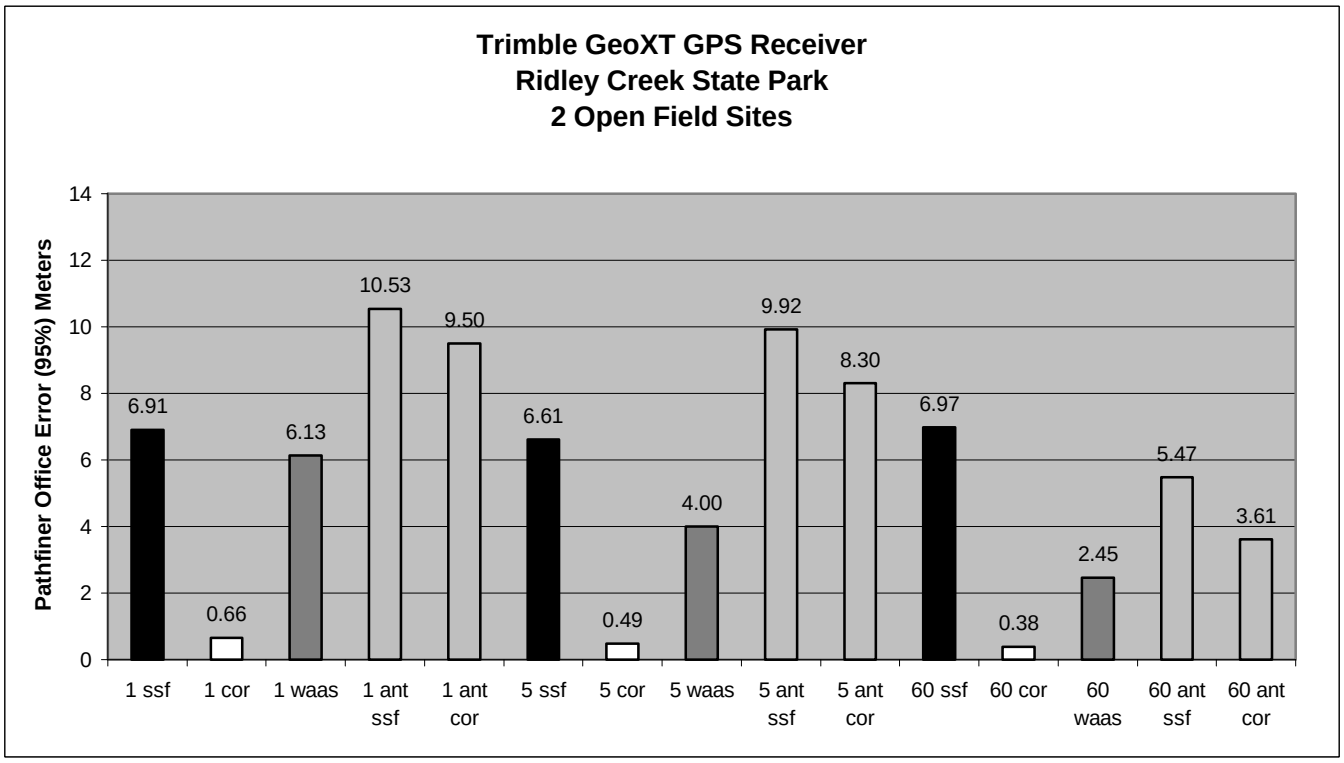


Chart 3.

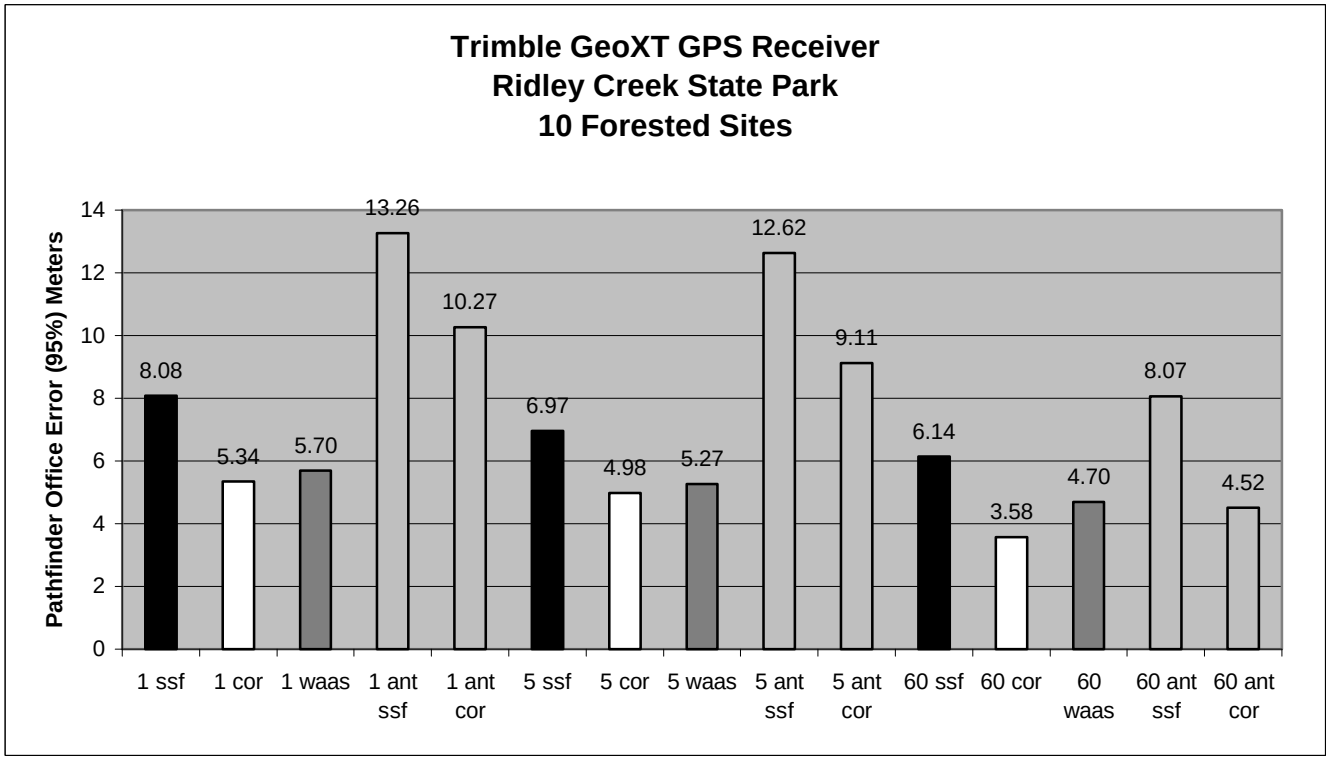
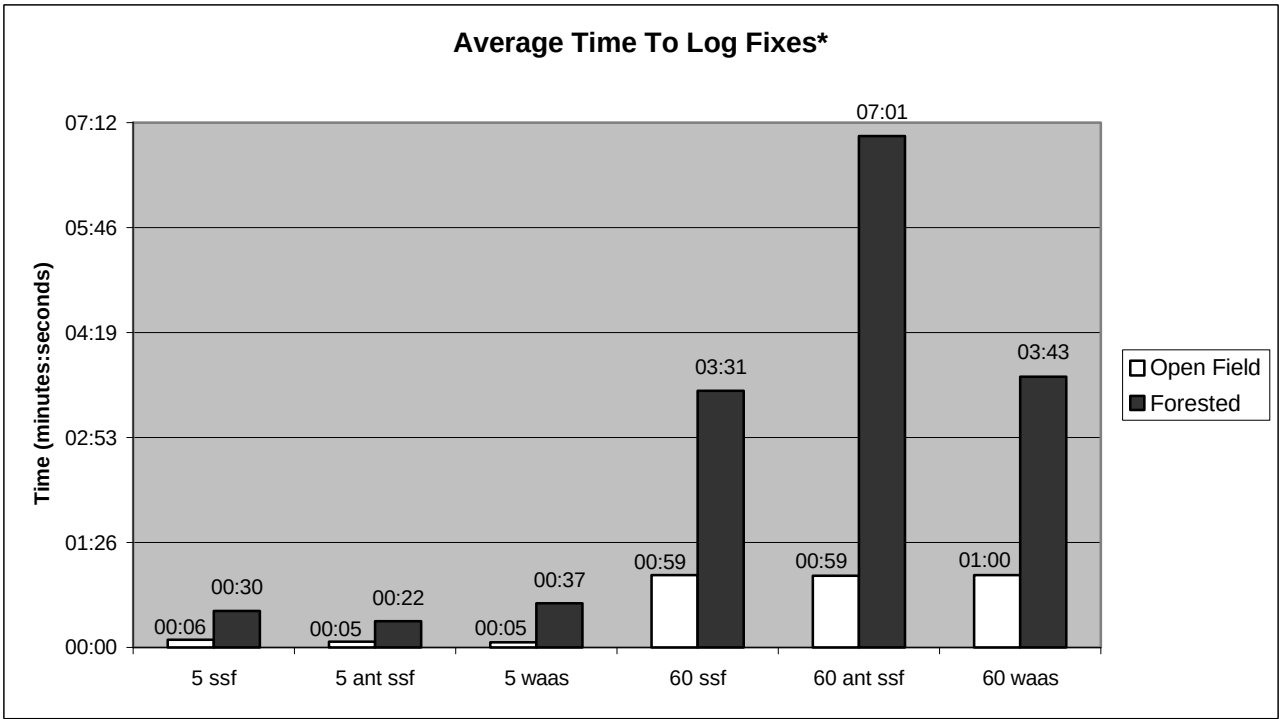


Chart 4.

		CHES CORS SITE		NJDEP SITE	
Open Field Positions	**No. of Fixes**	**95% Prob (m)**	**95% Range (m)**	**95% Prob (m)**	**95% Range (m)**
Trimble GeoXT Int. Ant Uncorrected	1 Position	6.91	4 - 12		
Trimble GeoXT Int. Ant. Post-Processed	1 Position	0.80	0.3 - 2	0.66	0.3 - 2
Trimble GeoXT WAAS Int. Ant.	1 Position	6.13	2 - 15		
Trimble GeoXT Ext. Ant. Uncorrected	1 Position	10.53	3 - 27		
Trimble GeoXT Ext. Ant. Post-Processed	1 Position	9.83	3 - 21	9.50	2 - 21
Trimble GeoXT Int. Ant. Uncorrected	5 Position Avg	6.61	2 - 12		
Trimble GeoXT Int. Ant. Post-Processed	5 Position Avg	0.55	0.3 - 0.9	0.49	0.3 - 0.6
Trimble GeoXT WAAS Int. Ant.	5 Position Avg	4.00	2 - 8		
Trimble GeoXT Ext. Ant. Uncorrected	5 Position Avg	9.92	3 - 21		
Trimble GeoXT Ext. Ant. Post-Processed	5 Position Avg	8.55	2 - 24	8.30	2 - 24
Trimble GeoXT Int. Ant. Uncorrected	60 Position Avg	6.97	3 -11		
Trimble GeoXT Int. Ant. Post-Processed	60 Position Avg	0.51	0.2 - 0.9	0.38	.07 - 0.9
Trimble GeoXT WAAS Int. Ant.	60 Position Avg	2.45	2 - 4		
Trimble GeoXT Ext. Ant. Uncorrected	60 Position Avg	5.47	0.9 - 16		
Trimble GeoXT Ext. Ant. Post-Processed	60 Position Avg	3.71	1 - 6	3.61	1 - 5
		CHES CORS SITE		**NJDEP SITE**	
Forested Positions	**No. of Fixes**	**95% Prob (m)**	**95% Range (m)**	**95% Prob (m)**	**95% Range (m)**
Trimble GeoXT Int. Ant. Uncorrected	1 Position	8.08	1 -25		
Trimble GeoXT Int. Ant. Post-Processed	1 Position	5.17	0.7 - 24	5.34	0.9 - 23
Trimble GeoXT WAAS Int. Ant.	1 Position	5.70	0.4 - 17		
Trimble GeoXT Ext. Ant. Uncorrected	1 Position	13.26	0.3 - 39		
Trimble GeoXT Ext. Ant. Post-Processed	1 Position	10.35	0.5 - 37	10.27	0.2 - 37
Trimble GeoXT Int. Ant. Uncorrected	5 Position Avg	6.97	0.8 - 19		
Trimble GeoXT Int. Ant. Post-Processed	5 Position Avg	4.93	0.7 - 21	4.98	0.07 - 20
Trimble GeoXT WAAS Int. Ant.	5 Position Avg	5.27	1 - 13		
Trimble GeoXT Ext. Ant. Uncorrected	5 Position Avg	12.62	2 -31		
Trimble GeoXT Ext. Ant. Post-Processed	5 Position Avg	9.07	2 - 27	9.11	1 - 27
Trimble GeoXT Int. Ant. Uncorrected	60 Position Avg	6.14	1 -13		
Trimble GeoXT Int. Ant. Post-Processed	60 Position Avg	3.60	0.7 - 13	3.58	0.5 - 13
Trimble GeoXT WAAS Int. Ant.	60 Position Avg	4.70	0.4 - 16		
Trimble GeoXT Ext. Ant. Uncorrected	60 Position Avg	8.07	1 - 24		
Trimble GeoXT Ext. Ant. Post-Processed	60 Position Avg	4.59	0.5 - 15	4.52	0.5 - 16

Chart 5. Range of maximum and minimum horizontal errors at the 95% confidence level as calculated by Pathfinder Office.



*Time was calculated from when the log file was open until the log file was closed. WAAS fixes collected with internal antenna only.

Ridley Creek State Park GPS Test Network Photos, October 2002