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> ## White Paper: MobileMapper Pro Accuracy with Post-Processed Differential Correction

25 April 2007

Accuracy Test Parameters

Accuracy tests were conducted over several days under different constellations of GPS satellites. Various configurations were also tested. The "rover" receivers were all MobileMapper Pros but some of the tests were conducted using the MobileMapper Pro's internal antenna and some were conducted using the external L1 antenna from a Magellan ProMark2 survey system. Some data was collected with the receiver held horizontal to the ground and some with the receiver held vertically. (The MobileMapper Pro's antenna functions best when vertical.)

Various reference station receivers were used: MobileMapper Pro with internal and external antenna, a Magellan iCGRS geodetic-grade receiver and two survey grade receivers used at US National Geodetic Survey CORS sites.

Accuracy Test Results

The table below summarizes the post-processing accuracies attainable with MobileMapper Pro. In general PDOPs were in the 3- to 5-meter range and the number of satellites tracked was between 5 and 9.

	Average Error (in meters) Rover Antenna	
Base Station	Internal	ProMark2
Real-Time	2.0	1.1
iCGRS	0.8	0.4
MM-PM2 antenna	0.8	0.7
MM-Internal antenna	1.1	N/A
CORS (48 km)	0.7	0.5
PP Average Error =	**0.9**	**0.6**

In most cases, WAAS corrections were used in real-time. The post-processing engine, however, does not use these corrections. MobileMapper Pro with the post-processing option is able to deliver 70-cm accuracy on baselines up to 48 km using the receiver's internal antenna. Using an external antenna it delivered 50-cm accuracy on the same 48 km baseline. On shorter baselines MobileMapper Pro is capable of 40-cm accuracy. Across all the tests, accuracy with the MobileMapper Pro receiver is 0.9 m with internal antenna and 0.6 m with a ProMark2 external antenna.

In addition to achieving sub-meter accuracy for point features, the new MobileMapper Pro post-processing option also allows differential correction to sub-meter accuracy of all points making up line and area features. The result is not only accuracy in an absolute sense, i.e. each point is within one meter of where the MobileMapper Pro receiver actually was, but the map representation of entire line or area features more closely match their actual shape.

The illustration below is a MobileMapper Office map screen showing a series of line features recorded while walking out the word "sub-meter" in a parking lot. Each letter is about 4.5 meters tall and 2.5 meters wide. Painted lines marking out parking spaces were used as a guideline. The receiver, with internal antenna, was hand-held while the person recording the "map" estimated where to hold the receiver to best spell out the letters.

Not only is each point making up the letters within one meter of truth, the shapes of each individual line feature are true to form. This allows users to map line and area features with a high degree of detail.
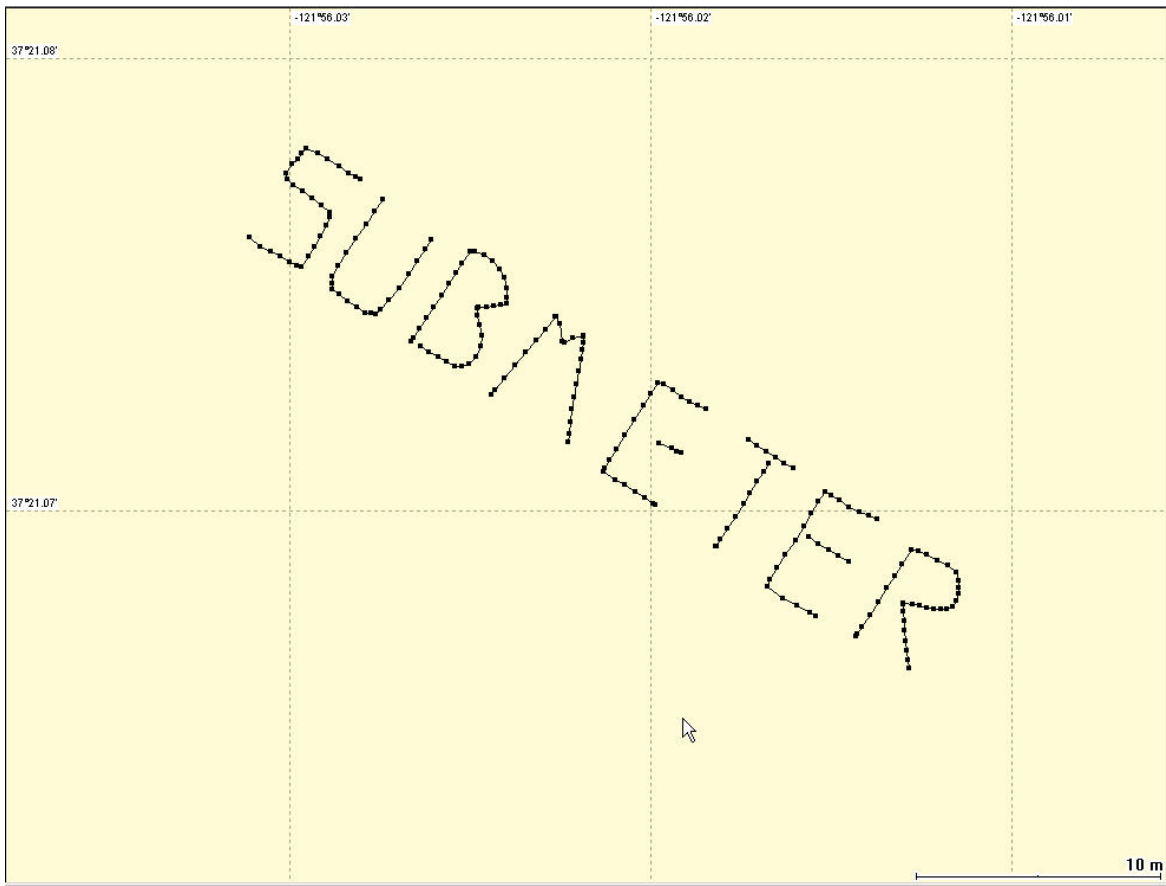
This high degree of precision provided by MobileMapper Pro's post-processed differential correction also supports the calculation of the area of polygonal features. The example below is of an architectural feature 6.64 m in diameter that comprises an area of 34.63 square meters. After differential correction in MobileMapper Office and export to MIF format, MapInfo calculated the recorded area to be 34.61 square meters (0.5% error).
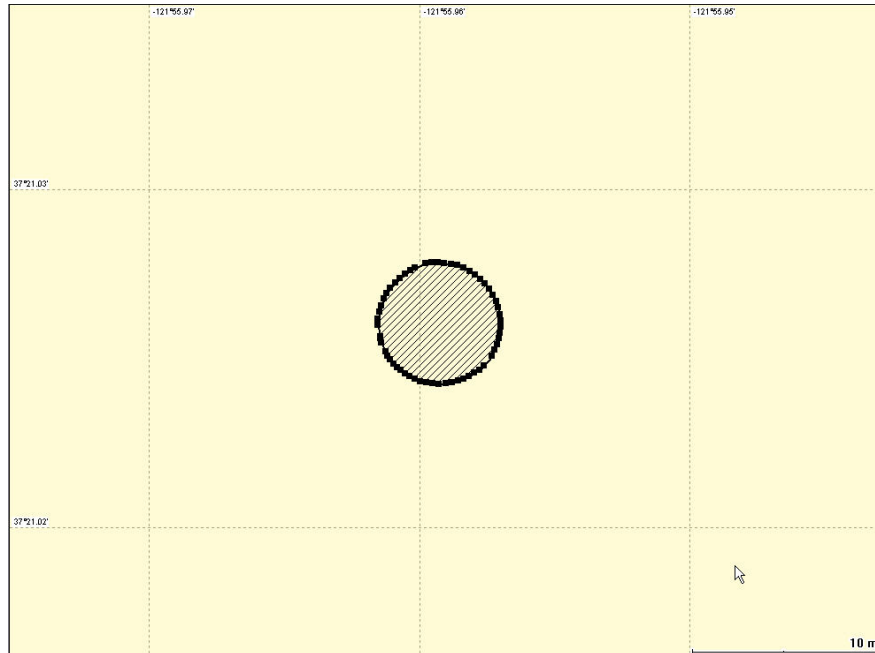
Requirements for Sub-meter Accuracy

The MobileMapper Pro system records and processes continuous streams of GPS carrier phase information to deliver sub-meter accuracy. The longer this stream of data is unbroken, the better the accuracy will be. Because carrier phase signals are sensitive to environmental factors such as tree canopy, it is important to have an open view of the sky as much as possible.

In addition, sub-meter accuracy can only be achieved with relatively low PDOP (Positional Dilution of Precision) and a sufficient number of satellites tracked by the receiver. If the PDOP goes much higher than 4 or 5 and if the number of tracked satellites is less than 5, the probability of sub-meter accuracy will be less than the specified 95%.

There are five basic rules for recording MobileMapper Pro rover data that can be post-processed to sub-meter accuracy.

1. All features must be logged while the receiver is continuously tracking at least 5 satellites with a PDOP less than 4 *for at least 20 minutes*.
2. Allow the receiver to have full "view" of the sky *the entire time a job is open, not just when a feature is open.*
   a. While you do not need a survey-grade external antenna for sub-meter accuracy, using one will yield better accuracy.

    b. If you are not using an external antenna, keep the MobileMapper Pro receiver *vertical* the entire time a job is open.

    c. If you are not using an external antenna, keep the MobileMapper Pro receiver *at eye level* the entire time a job is open.

3. Keep the receiver (or external antenna) stationary for 5-10 seconds before opening any point feature.

4. Average all point features for at least 30 seconds.

5. Use a one-second logging interval and move as steadily as possible while recording line an area features.

For more information on how to optimize accuracy with the MobileMapper Pro, download "Optimizing Accuracy with MM Pro.PDF" from the /Mobile Mapping/MM Pro/Application Notes/ folder of ftp.magellangps.com.