

GIS on the Go

Review Leica MobileMatriX and SmartRover

With geoinformation invading every aspect of our everyday life, its acquisition is becoming more and more important. In the 'good old days', the client was satisfied with a bunch of accurate positions, a survey plan and a well-written survey report. Nowadays additional information needs to be acquired besides the position information. We reviewed Leica MobileMatriX together with the

Leica SmartRover GPS.

By Huibert-Jan Lekkerkerk



Leica MobileMatriX and SmartRover

Leica MobileMatriX is essentially an ESRI ArcGIS extension (ArcMap and ArcCatalog) designed specifically for acquiring geoinformation from survey instruments in the broadest sense. The software can be coupled to all of the Leica Geosystems (hereafter: Leica) survey and GIS instruments, as well as NMEA-type GPS systems. For this review the software was paired with a SmartRover integrated GPS receiver/antenna. Since no base station was available, the combination was tested using regular GPS with WAAS/Egnos correc-

tions -- maybe not precise enough for land survey work, but good enough for general GIS acquisition.

SmartRover

The SmartRover GPS is available in a number of different versions. The SmartRover we reviewed, the GX 1230 GG, is claimed by Leica to be the lightest survey-grade GPS system available. And although we did not weigh all other available systems, it must be granted that it is light in weight.

Both controller and antenna are very light without compromising robustness. The antenna is rimmed with rubber, protecting it from an accidental drop. As with all modern GPS/controller combinations, this one uses Bluetooth as well. A minor disappointment came when the controller was switched on. After reviewing a number of similar devices, one expects a full colour LCD screen. Not in the case of the Leica, where the controller was in old-fashioned grayscale. This, of course, does not in any way hamper the operation, but it seems a bit out of date.

Leica MobileMatriX

As stated before, Leica MobileMatriX is essentially a custom extension for ArcMap. In the field it will usually be installed onto a tablet PC. For ease of operation the tablet PC should have Bluetooth, although a USB connection is possible as well. The GPS, Total Station or level instrument can be controlled from the software without having to use the sensors' own controller.

The advantage of using ArcMap is that all GIS functionality is kept, allowing extensive editing and data review in the field. Furthermore, if the office software is ESRI-based as well, transfer of data is simply a matter of checking the data into or out of the office database.

The downside is that ArcMap requires a rather powerful computer with minimum specifications of 850 MHz and 512 Mb internal memory. This does not seem much, but I tested the software on a 2.23 MHz Pentium-M with 1024 Mb of memory and, even with this configuration, starting ArcMap including the Leica MobileMatriX extension takes nearly a minute or so.

Tablet PC or PDA

One might ask why a Tablet PC solution should be preferred over a PDA based solution. The obvious advantage of the PDA is of course its weight and size. Size than again can also be a disadvantage since the screen is usually a lot smaller and has a lower resolution. On the other hand, PDA's usually run much longer on a single battery charge than the average Tablet PC. The main advantage of the Tablet PC is that it allows the user to run the same software in the field as in the office. It is usually a lot more powerful and allows editing on a full-size geodatabase instead of a small size database created specifically for the purpose.

Number of channels	54 (14 GPS satellites at L1 & L2, 12 GLONASS satellites at L1 & L2 and 2 SBAS channels)
Battery life	5 hours on internal replaceable battery
Interface	Bluetooth, USB, compact flash card
Recording rate	Up to 20 Hz
Dimensions (receiver)	W: 212 mm x L: 166 mm x D: 79 mm
Weight (complete system)	2.8 kg

SmartRover GX 1230 GG particulars as specified by Leica (ppm = parts per million = mm / km range).



Complete Leica SmartRover set as tested. Inset is software controller from Leica MobileMatriX

Installation

The SmartRover was ready out of the box, with all the settings pre-configured for the Netherlands. It had not been used for quite a while and took some time to initialize, but after that it was good to go. The installation of the software took quite a bit more time and was performed by Leica Netherlands.

The bare software installation took approximately half an hour, of which time most was consumed by the ArcMap installation.

Pairing the SmartRover to the computer was easy enough, but after that some problems arose. It seemed that Leica MobileMatriX was not registering the positions from the SmartRover but was running on simulated positions. Eventually it turned out to be a combination of factors. First, the installed CD-ROM installed two simulators by default of which one should not be installed. In addition, some specific geodetic transformation files were needed that were not included in the standard installation. All this led me to believe that installing Leica MobileMatriX is a job for an expert, best left to the supplier of the software or a qualified system administrator.

Preparations

Since we only had meter accuracy from the SmartRover, there was no use in performing a large-scale survey. Instead I decided to do a small survey of a road and dike while on the way to my parents to celebrate the Dutch 'Sinterklaas', who is a bit like Santa Claus but celebrates his birthday on December 5. And yes, this means that we have two lots of festivities with presents in the same month...

Anyway, I wanted to prepare myself and 'grabbed' some images from Google Maps. After stitching them together using Photoshop I had a half-decent aerial photograph of my survey area. I wanted to measure the centreline of the road and dike as well as some specific points

that would come up along the way.

The procedure in Leica MobileMatriX for starting a new project is easy enough: simply select the features you want to measure in the field or import them from a previous project. If the original data is in the office database, it can be checked out from that database and then used in Leica MobileMatriX.

Since the system has full GIS capabilities, viewing and selecting layers is as easy as it is in any other ESRI product. Unfortunately I am not accustomed to ESRI products and it took a while to find some functionality as some of it is hidden in toolbars instead of appearing on the menu where you would expect it.

Is this then all the result of the software, one might ask? No, it is not, since Leica asked me about my GIS proficiency before they agreed to the review. I replied truthfully that I was fully aware of how a GIS worked and also confessed to never having used ArcGIS, but then stated that no software package had gotten me to my knees so far. ArcGIS almost succeeded, but after some searching I got it all to work.

Surveying

After setting up the software, it was time to start the survey. So far I have been quite lucky with the weather when reviewing GPS systems, but this time I seemed to have cursed the weather gods.

Just minutes before I left it started pouring and only stopped after I had arrived at my destination. As a result the system was tested from the dashboard of the car, with a quick dash outside every now and then.

If you think that I, as a former (hydrographic) surveyor, cannot stand the rain, you are absolutely right. However, my main concern was the computer. Since I did not have a powerful laptop available myself I borrowed one from the office, and this one was not waterproof.

A breast harness (TabletPC holder) was provid-

ed with the set for carrying a tablet PC. Since I have been doing a lot of office work lately it seems that I am carrying around more weight than I used to, and this may be the reason why the harness did not fit quite right. After a couple of minutes it started feeling uncomfortable even though I tried out different settings of the harness bands. When stored in the downright position the tablet blocks the entire downwards field of vision. When stored upright, the blocked area is noticeably smaller but still blocks part of the downward view. When walking in the field this could become catastrophic as you may imagine. A solution where the laptop can be stored sideways would probably be safer, but will probably be less easy to wear.

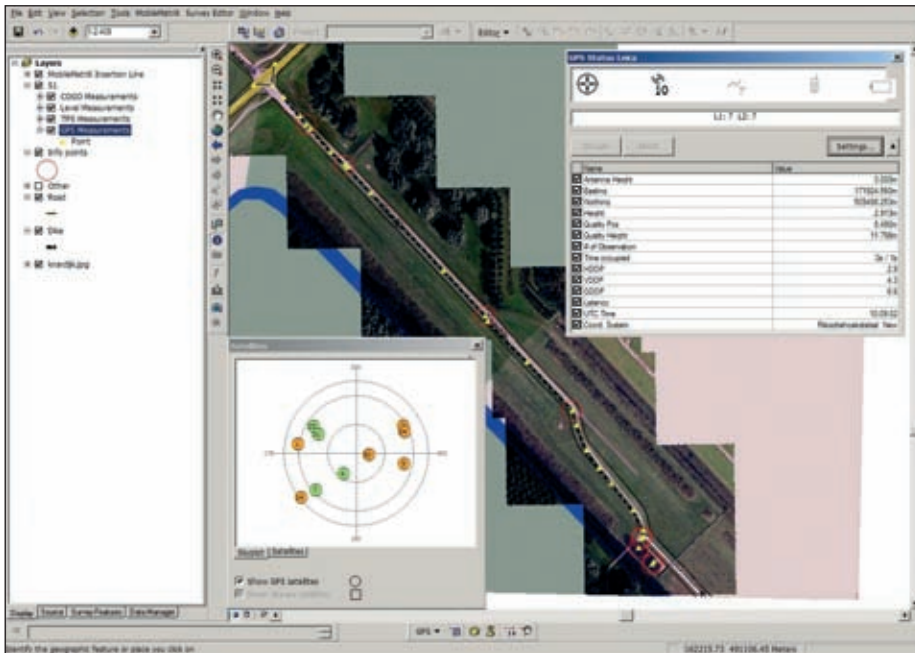
Acquiring Data

Operating the computer and holding the GPS steady at the same time is quite difficult. The system can, however, be operated by a two-man (or woman) team without difficulty, owing to the Bluetooth connection. This would not necessarily cost more time, since the computer operator could input the feature attribute data while the GPS surveyor is moving to the next point to be surveyed.

Surveying the points is a bit more complicated than with a stand-alone GPS system due to the full GIS interface. The basic operation is the same, but due to the number of options in the software selecting the right feature involves clicking through more menus. Leica however promised that the next release of MobileMatriX,



Measuring a survey point using a Tablet PC



Leica MobileMatriX online screen with GPS status and control windows as well as survey area and surveyed points.

which is due in March 2007 will solve this. An advantage is that all points measured are directly connected to a feature selected in the GIS system. For each point, additional attributes can be entered. A truly great option is that multiple features can be surveyed at the same time. For example, start surveying the main road. When passing a house, simply pause the survey of the road and survey the house. Close the survey of the house and return to the road to resume work.

There is also the option to survey multiple features at the same instance. For example, a position can be attached to both the road and the house whereas with most other systems one has to choose. Last but not least there is the option to edit imported features from the database, easily facilitating updating of the office database in the field.

The main disadvantage of using GIS software

is that some options that are available on a regular system are not available. For Example the current version of Leica MobileMatriX does not support GLONASS, thereby reducing the SmartRover we used to a standard GPS receiver. Leica however promised that GLONASS support would be included in the next version of Leica MobileMatriX.

Processing

When all data has been acquired correctly in the field, hardly any processing whatsoever is needed. When necessary, additional data points or features can be entered or edited afterward. The data is then checked out or exported from the geo database.

The only disadvantage I could find is that only a few export formats were available in the version I used. This however may not be a big problem since Leica MobileMatriX will probably

appeal primarily to users with ESRI software in the office. Of course one could use the Data Interoperability Extension from ArcGIS, but I believe this to be a rather expensive solution when only used for exporting data from a mobile mapping system.

Mobile Watis

In the Netherlands a specific application, Mobile Watis, is used on top of Leica MobileMatriX by a number of Dutch water boards. Almost all water boards use the same system, Intwix, for storing geographic-related data. With ever-changing watercourses, kilometers of dikes and objects such as sluices and pumps, a lot of surveying is done.

Since all the object types are standardized with standardized attributes it is possible to create a custom application specifically for acquiring the information needed for the water boards. Besides the standard functionality of Leica MobileMatriX or ArcMap, AquaGIS developed additional dialogues, making data entry even faster and easier for the surveyor.

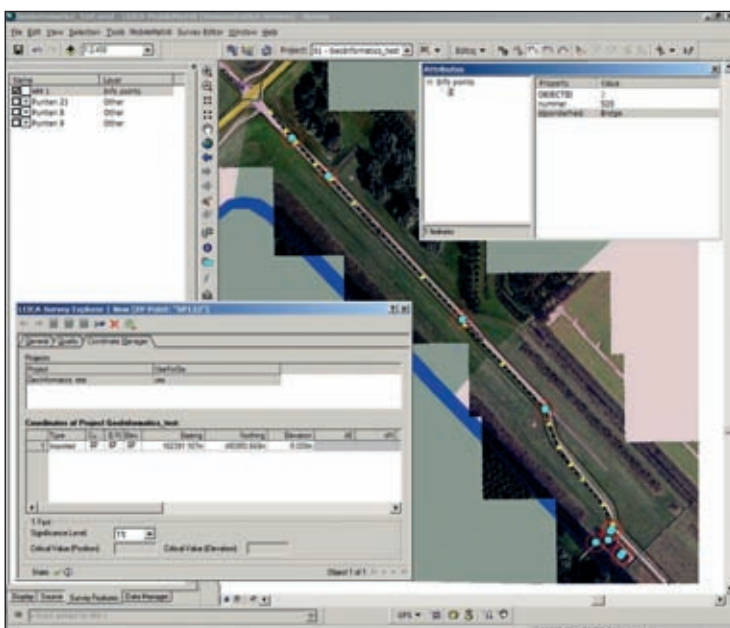
Conclusion

The SmartRover performs exactly as expected, as far as I could see. I found Leica MobileMatriX to be a versatile but complex software package when compared to stand-alone GPS-GIS collection tools.. The possibilities are endless and allow for data acquisition without the need to convert or process the data into the office GIS database. If you decide to use the software, let Leica do the installation and make certain all operators are fully trained. A potential solution to make the software easier to operate is to use customized applications that run on top of Leica MobileMatriX, such as Mobile Watis.

Finally, I would recommend a survey team of two for quick and easy data acquisition. One man can then position the GPS while the other enters the attribute information. In my estimation the total survey time would be similar to a one man survey team. Furthermore some countries will require a two man team in certain areas for safety precautions. In short, Leica MobileMatriX is a good solution when a lot of attributes need to be related to geographic features or when a large number of changing features stored in the office database need to be re-surveyed on a regular basis. It is however quite a heavy package for simple, one time, GIS data collection.

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Leica MobileMatriX screen with window for adding a point and reviewing attributes.