

Apple Enters the Surveying Equipment Market

In June, 2009, Apple Computer entered the surveying equipment market, releasing a new total-station-like instrument. This instrument is aimed at the mass consumer market and provides powerful yet easy-to-use data collection capabilities. With its ability to link to high-performance computing environments, the instrument will allow users to undertake large-scale spatial data processing and distribution. — By N.W.J. Hazelton



THE NEW INSTRUMENT Apple has named this new surveying instrument the iPhone 3G S. In the Apple World Wide Developer Conference (WWDC) keynote where the announcement was made <<http://www.apple.com/>>, the various presenters overlooked calling it a surveying instrument, preferring to think of it primarily as a smart phone. Had Steve Jobs been doing the keynote, I suspect he would have said something along the lines of, "There's one more thing... we're going into geomatics."

Although Apple may be selling it as a smart phone, this is a surveying instrument. The iPhone has 3-D location capabilities using GPS and "triangulation" from cell-phone towers. (It's only a matter of time before the same approach can be used from any WiFi router as well, once WiFi routers broadcast their location.)

The 3G S also has 3-D orientation capabilities, using accelerometers and a digital magnetic compass. The iPhone allows the GPS location to be used to determine magnetic declination automatically, so the user can select true or magnetic orientation. In addition, the compass orientation can be used to re-orient maps so that they line up with how the iPhone is oriented.

Using a 3-megapixel camera, as well as VGA-resolution video at 30 fps, large amounts of spatial data can be collected as quickly as the user can move around.

In addition, the iPhone can be connected to external accessories, either by cable or

Bluetooth, allowing laser distance meters, total stations, high-resolution cameras, and other equipment to be integrated with core measurement and computational systems. Connection to a small external RLG would bring the iPhone much closer to being an integrated GPS/INS device.

The iPhone has a certain amount of internal computing power, as well as up to 32 Gb of RAM, but its primary computational strength is its ability to pass data to a cloud computing environment, and control the almost unlimited computational resources available there.

Being able to connect using WiFi, Edge, and the general cellular network, the iPhone allows various means of access to the Internet. The recent release of Opera Unite will enable free peer-to-peer file sharing between the iPhone and any computer running the software, <<http://unite.opera.com>>. The iPhone can be tethered to another device, either by USB cable or by Bluetooth, and used as a connection to the Internet. This would allow data to be transferred between the field and the office via a cell phone connection. A laptop, netbook, total station, or other device can now connect directly to a remote computing environment almost anywhere there is a cell phone connection.

PRECISION At present, the iPhone's measurement precision is fairly low, by surveying standards. It can provide a 3-D

location to no better than a few meters. While this is generally too imprecise for most current surveying needs, two questions come to mind. How long will it take to improve precision? What tasks and users will this precision satisfy?

The answer to the first question is that there are already moves underway to improve precision. At the keynote, representatives from TomTom indicated that they were developing an accessory that improved the GPS signal. No-one has yet released an application to link the iPhone's GPS into a virtual GPS reference system. The iPhone includes software to calibrate the digital compass, and it should be fairly straightforward to calibrate the accelerometers and the camera. It would be an interesting research project to calibrate these aspects of the iPhone and explore its measurement precision.

Using digital photogrammetry to stitch together 3-D models based on stereo imagery controlled by the iPhone's location and orientation capabilities and connectivity (including access to databases of control points) will provide extensive, high-precision data sets, where the whole model may be easily located and oriented in space. This will enable significantly improved precision in data collection once the resources are marshaled to process it. Running a digital photogrammetry software suite in a cloud computing environment would make it possible to manage this processing directly from the iPhone.

I think that improvements in precision will come quickly—if people demand it. Software development for the iPhone seems relatively easy, so it would be a matter of hardware improvement or better use of accessories.

The second question concerning tasks and users is much more complex. It goes to the heart of the disruptive nature of this instrument.

MASS CONSUMER SURVEYING By June, 2009, Apple had sold 40 million of the previous models of the iPhone and iPod Touch devices, worldwide. (The iPod Touch is an iPhone without the phone

capability.) It is reasonable to assume that a fair proportion of users of these devices will be upgraded to the iPhone 3G S, in addition to new buyers. So we can expect to see tens of millions of these devices in use around the world in the near future. In fact, Apple sold over one million iPhone 3G S units worldwide during the first weekend it was released. How will these people use their iPhones?

The true meaning of the iPhone 3G S is that it puts basic surveying capabilities into the hands of anyone who can afford the purchase price (about \$300) and the monthly network charges.

Naturally, a sizable number of iPhones will be used as little more than phones, music players, web browsers, and game platforms. Even if 90 percent of users do nothing more than this, the other 10 percent of users, numbering several millions, will do other interesting things with their iPhones.

The true meaning of the iPhone 3G S is that it puts basic surveying capabilities into the hands of anyone who can afford the purchase price (about \$300) and the monthly network charges. The connectivity potential of the iPhone allows users to add their spatial data to Flickr, Google Maps, Google Earth, and other sites.

The instrument can also be used as a basic mapping tool, and the data could be fed directly into a GIS, such as ArcGIS. Millions of people using the iPhone as a surveying instrument will change the nature of spatial data use, because much of this spatial data will be freely available and contain data otherwise very hard to obtain.

One of the changes that came with GPS was that a receiver could be linked to any kind of data collection device, e.g., an electricity or water meter reader's data collector, which allowed the loca-

tion of all operational water meters or electricity meters to be mapped with almost no additional effort.

The idea of digitizing data directly from the Earth at a 1:1 scale changed the nature and precision of mapped data. Many people are recording their every activity and thought on sites such as Facebook and MySpace, so if their location and some image data can also be recorded and disseminated, the quantities of spatial data available start to grow exponentially.

With the iPhone it is simple to buy, download, and install any application, so an application that facilitates 3-D data collection and uploading to websites would be extremely easy to disseminate.

In its first nine months of operation, the iPhone App Store served one billion downloads of software applications for the iPhone and iPod Touch, and currently has over 15,000 applications. This includes free applications. An application that integrates the various measurement capabilities of the iPhone and makes it possible to upload the resulting data to a website could be disseminated to thousands of users in a matter of hours.

For most users, three-meter precision is more than good enough for their spatial data needs. Anything better than this for most needs will lead to confusion (over datums, projections, etc.) and dangerous assumptions (e.g., that the coordinates represent a property corner). But what does this mean for the surveying industry? What happens when precision is, inevitably, improved?

THE MISSING PIECES In a world where anyone can measure and collect spatial data there is little advantage to being a "measurement expert." It's rather like being an "expert" in spoken English in a country where everybody speaks English. Spatial measurement, and more particularly spatial location, will become almost as ubiquitous as spoken English, and many people will try to incorporate such measurements in their work or lives. Like language, spatial data will be a way to link together experiences and knowl-

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edge between people. We have started to explore the potential of such data through maps and images, but the potential of applications such as Google Maps is only now beginning to show.

We can expect to see a boom in the need for spatial data, and, given the “nature of the beast,” it will probably be largely met by individuals who are not surveyors. How can the surveying industry capitalize on this growth?

Rubinson (2009) has suggested that there are four dimensions of human life and interaction. By analogy there are four ways that a “brand” (surveying, geomatics) can be relevant: functional, social, self-expressive, and for its content. The more ways we can make surveying and geomatics relevant to a large number of people when they are thinking about how people live and interact, the more successful and relevant surveying and geomatics will be.

Current data collection methods provide relatively easy answers to the questions “what,” “who,” and “where.” The iPhone will make this even easier for millions of people. Competing devices, some of which are already on the market, and many others in development over the coming years, will provide similar capabilities. Apple’s iPhoto software allows semi-automatic tagging of faces in images, in addition to geographical location of images, and Facebook supports face tagging in uploaded images.

The answer to the question “when” can only be answered by current systems by simple time-stamping of the data. In an “experiential” society, which is one interpretation of current lives and lifestyles, there is a need to interweave various time lines, and time stamps are not good enough for this, especially when later analysis is predicated. As current GIS and similar systems are not very good at working with the temporal aspects of spatial data, this is an area where there is potential for creative involvement.

The critical questions of “why” and “how” go beyond measurement, data and information, into the areas of knowledge and understanding. It is here that there are major opportunities.

Beyond advanced expertise in measurement science, the surveying profession

should look at how it can support the growing use of spatial data. Provision of our own measurements is not the issue; it is providing an infrastructure for others to do what they want to do themselves, but in a sensible and meaningful way. Spatial data management is the first step, as we need to apply pattern recognition and information analysis techniques to generate more useful products for the non-surveying user community.

GPS for surveying measurement was one area where we were slow to be involved. GIS took off and rushed away without us, and is beyond recall. They were both technologies for specialized users, perhaps a few tens of thousands. This new measurement technology, supporting infrastructure and way of life that is exemplified by the iPhone, is for the billions of potential users out there.

If we want to be part of this world, the time to start is now. It must be done as a collective effort, but made up of many individual efforts, in the same way that the keys to the new technologies are integration, collaboration, and sharing.

Critically, whatever is done must be about the users, their lives, interactions and needs, not the profession. If users come first, the profession’s position is assured. Compare the number of surveyor users (thousands) to non-surveyor users (billions), and decide whom you want as clients: both groups, or just the smaller?

FINAL NOTE The iPhone itself is not the key here: its supported processes are where the focus needs to be. Technology comes and goes, and next week it will be something newer. The iPhone is just an icon of this change, in the same way that the iPod changes the way we deal with digital media.

Reference

Rubinson, J., 2009. The New Rules of Brand Competition. Fast Company on-line. 21st June, 2009. <http://www.fastcompany.com/blog/joel-rubinson/brave-new-marketing/new-rules-brand-competition>