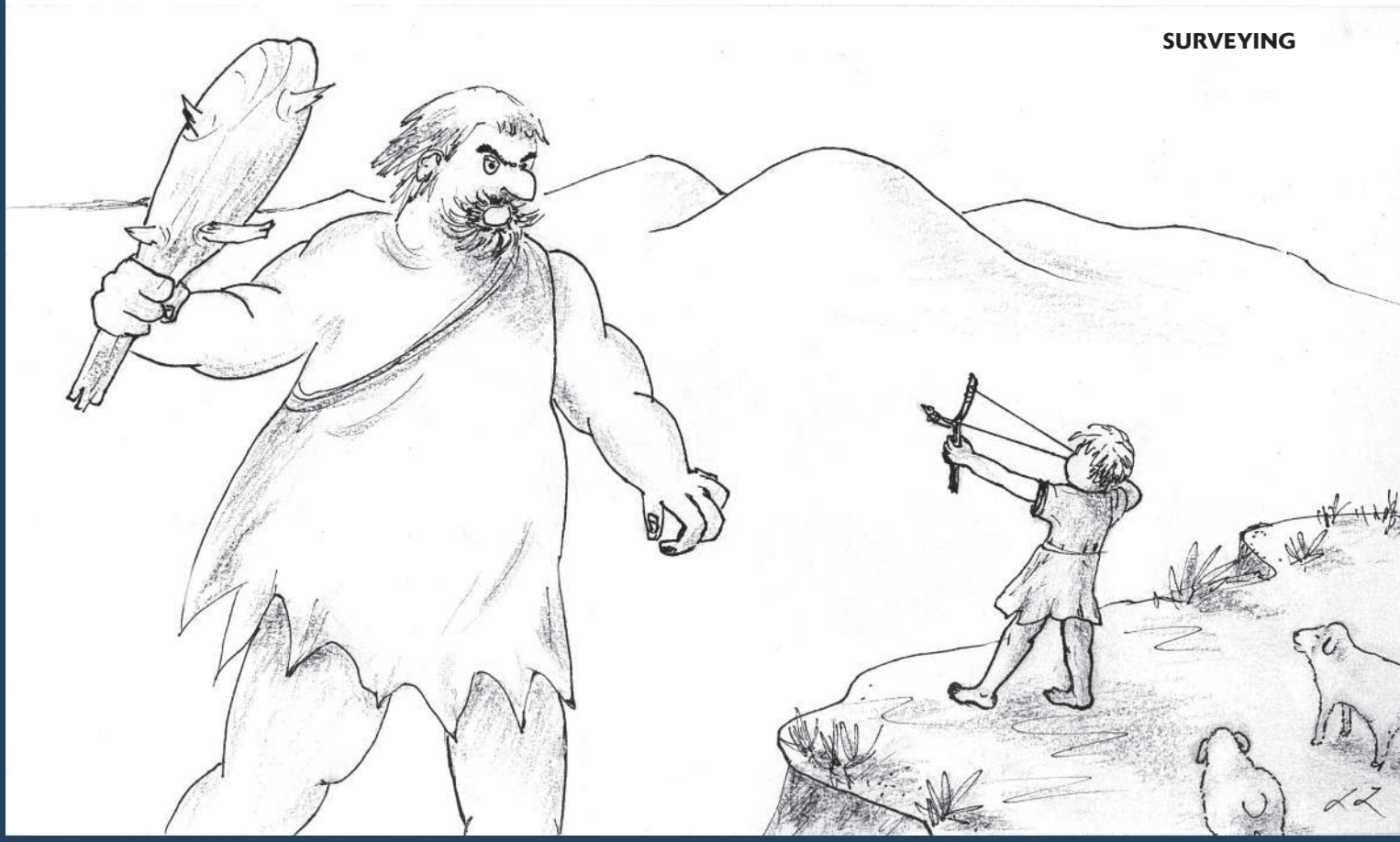


RTK GPS SURVEYING WITH YOUR IPHONE

IPADS AND IPHONES HAVE REVOLUTIONISED THE CONSUMER MARKET, BUT ARE THEY READY TO REVOLUTIONISE THE HIGH-PRECISION GPS SURVEYING MARKET. LYDIA LIN LOOKS AT WHAT SURVEYORS NEED TO DO TO INCLUDE THEM IN THEIR TOOLKITS

GPS/GIS systems are important tools for recording, organising, analysing and presenting location-based data for various industries, organisations and government agencies. During the past two and a half decades, GPS professionals have witnessed the evolution of the old clunky GPS hardware into the sleek and smart palm-sized devices that we now know. The mobile nature of smartphones with built-in GPS lends itself well to geo-tagged data collection for diverse fields of application, such as farming, forestry, meter reading, wildlife management, military reconnaissance, asset tracking, crowd-sourcing, and so on. These versatile gadgets have become viable components of a GIS.

But not all GPS systems are equal. Fierce competition among the multitude of makes and models of mobile devices with built-in GPS has worked to the consumer's advantage. This has raised some people's hopes of bypassing expensive land-surveying services and take on a doing it themselves. However, to obtain useful results, one will need to use precise GPS receivers and proper methodology. If you connect an iPhone by Bluetooth to an affordable GPS receiver that provides 1-3m accuracy, you could use a stakeout app to help navigate a property boundary and locate some old stakes. You could also acquire preliminary location data for planning a layout.

But such mapping-grade GPS receivers won't cut it for taking on a land survey job, which typically requires centimetre-level accuracy. While the static GPS data collection procedure produces more accurate results, real-time kinematic (RTK) GPS has gained popularity among surveyors because this method permits shorter time at each point and yields instant results, without the need for storing and post-processing the raw data. For the surveyor, this translates to an enormous increase in productivity without a significant sacrifice in accuracy.

A standard RTK GPS survey system consists of a stationary base station, a moving GPS receiver and data collector (rover), a mechanism for broadcasting the differential correction data from the reference base station to the rover, and software for computing the differential corrections, controlling the data flow as well as displaying in real-time the surveyed positions and the quality of the measurements. All the different components add up to a pretty sum that has kept many surveyors from abandoning their old total stations to switch over to GPS surveying.

Nearly there

The day of low-cost, high-precision GPS equipment has not yet arrived, but we are halfway there. Available now are base station networks that provide real-time differential correction data over the Internet. The ability to stream RTK corrections from such a network means we can cut out our own base station and the UHF radios used for transmitting the

correction data. The trend of price reduction for RTK GNSS receivers further boosts the cost savings. A number of the multi-constellation RTK GNSS receivers, such as the iSXBlue II+ and the EOS Arrow 200, come in compact sizes that are a breeze to take along anytime.

A modern GPS survey system usually incorporates a rugged Windows mobile device as the data recorder. They come with built-in WiFi and GNSS and/or they can connect to an external GPS receiver using Bluetooth or a cable. The price tag of such a data recorder plus the survey data collection software is typically upwards of US$3,000.

Many of us already have an iPad or an iPhone. Why not let it do double-duty as a data recorder and have one less item to buy for our RTK GPS system? Companies have already developed apps that permit an iOS device to serve as the data recorder in a RTK GPS system. Worth noting are the TerraGo Edge software for iOS and Android and the CMT iCMTGIS PRO for iPad and iPhone.

One must ask, though, whether an iOS device running such a software program is really up to the task. Let's take a look.

Up to the job?

Size and portability

The iPad has a little brother, the iPad mini, and the iPhone has grown into the iPhone 6 Plus, offering the user a few sizes to choose from. While a small device is easier to carry around, a larger device will let you comfortably work with a large-scale job map.

Ruggedness

You have taken the iPhone everywhere with you and it has served you well. Some of you have successfully used iPads for mapping. For severe field conditions, you could house your iPad and iPhone devices in shock-proof and water-proof cases.

Battery

Continued use of GPS consumes a large amount of power, but this is true of all GPS systems. You can turn off the GPS when you are not actively using it.

Display visibility under direct sunlight

This is where iOS devices pale against some of their competitors. It would be best to don a pair of polarised sunglasses or fit your device with an anti-glare screen cover.

Software capabilities

The mapping software must be able to record the GPS coordinates as well as descriptions and notes for the geographic features that you log or digitise as points, lines, and polygons over a background reference map. It should let you import and export data in a standard format, such as Shapefiles. It should let you view/print the collected data. Some apps will also let you make a deed plot, create grid points over an

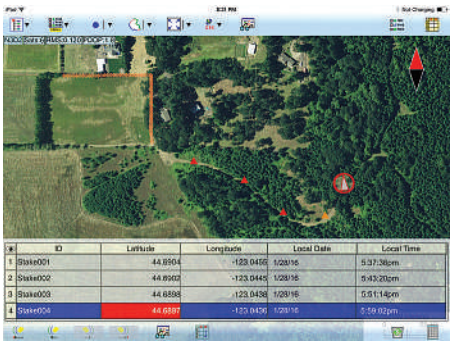
A mobile RTK system

area, draw contour lines or stake out points and boundaries. As the surveyor interacts directly with the app while performing a job, the app will need to be easy to learn and use.

RTK accuracy

A RTK GPS app must be able to display a GPS status indicator showing satellite status and the accuracy of the data in terms of RMS error values. Accuracy is of the upmost importance for the surveyor. The app should let the surveyor specify an error limit and only record data when the computed errors are within this limit. To achieve this on an iOS device, the app developer must work with the GPS manufacturer to allow the app to read the NMEA data directly from the GPS receiver.

For surveying and high-accuracy 3D GPS data collection projects, vertical accuracy must also be ensured. Some apps are able to apply the geoid separation data to elevation computations.



An iPhone surveying app

The iPad and iPhone were not born to be field data collectors. Nevertheless, the doggedness of app developers has pushed them into a head-to-head competition with other mobile data collectors in the RTK GPS survey and high-precision GPS/GIS data collection market.

THE DAY OF LOW-COST, HIGH-PRECISION GPS EQUIPMENT HAS NOT YET ARRIVED, BUT WE ARE HALFWAY THERE

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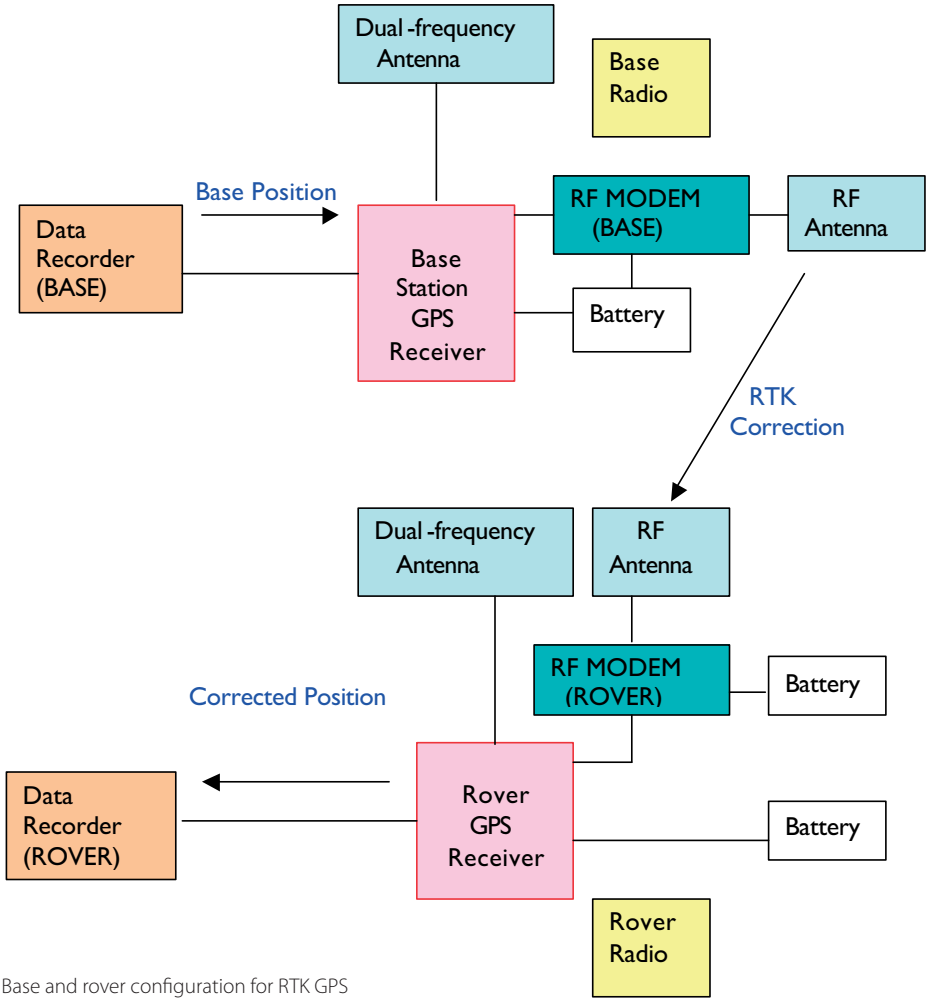

Base and rover configuration for RTK GPS