

## CLASSIFYING

Should this feature be shown on the map?

If so, which one of the standard symbols should be used?

## MEASURING

Mappers determine the position of new features

1. relative to distinct objects that are already on the map
2. by taking bearings and pace counting, or
3. from GPS tracks and waypoints.

Positions should be sufficiently accurate that competitors won't notice any positioning errors on the map. Careful mappers judging relative positions or taking bearings and pace counts usually can be more accurate than someone running in a race.

Approximate accuracies of GPS receivers:

Cell phone GPS within 5 to 10 m

Recreational grade GPS within 3 to 5 m, cost about \$120

GIS grade GPS within 1 m, cost about \$2000

Professional survey GPS within a few cm, cost about \$10,000

New GPS receivers with cm-level accuracy are becoming available for less than \$500.

## DRAWING

A good map is correct, complete and legible.

The best maps have artistic qualities, too.

Traditional field survey equipment was a light weight map board, a copy of the base map(s) and a mylar overlay, coloured pencils and an eraser. Field survey with a GPS and tablet or smartphone offers advantages in convenience, speed and accuracy.

## FIELD SURVEY EQUIPMENT LIST

### "Old style"

Map board  
Base map  
Air photo  
Drafting film (mylar,  
3 mil preferred, 5 mil OK)  
Masking tape  
Compass  
Scale  
Pencils  
    red  
    green  
    blue  
    black  
Eraser (stick type)  
Flagging tape  
Map case  
Scissors  
Straight edge

### "New style"

GPS receiver  
Tablet or smartphone  
Stylus  
USB powerbank

### "New style" tips

Double check the  
georeferencing  
parameters of the  
map before going  
to the field.

Load the map file  
and all template files  
into the OOM folder  
of your device.

### Comfort and safety

Day pack  
Lunch  
Water bottle  
Whistle  
Cell phone  
SPOT or InReach  
Bear spray  
First aid kit  
Toilet paper  
Rain gear  
Extra clothing  
Insect repellent  
Sunscreen  
Hat  
O shoes, rubber boots  
or hiking boots  
Spare socks

### "Old style" tips

Put registration marks on the base map and mylar.

Establish magnetic north and draw meridians.

After locating a feature with respect to one known point,  
check that it fits with everything else in the vicinity.

Work in a small block, surveying things in the following order:

    linear features, point features, contours, vegetation.

Keep the map clean and dry!

# MAP BOARD SETUP

Mylar a.k.a.  
Duralar or  
drafting film.  
Thickness 3 mil  
(0.003 inch).  
Matte finish.











Printed section  
of base map.

Corrugated  
plastic sheet.  
Thickness 4 mm.  
Cut 305 x 230 mm




































Field survey  
legend in  
page protector  
on back of  
map board
























-  Contour
-  Index contour
-  Form line
-  Earth wall
-  Gully
-  Small knoll
-  Elongated knoll
-  Small depression
-  Pit
-  Special landform feature

-  Impassable cliff
-  Passable rock face
-  Rocky pit
-  Boulder
-  Large boulder
-  Boulder field
-  Boulder cluster
-  Stony ground
-  Open sandy ground
-  Bare rock

-  Uncrossable body of water
-  Pond
-  Waterhole
-  Uncrossable stream or river
-  Crossable watercourse >= 2 m
-  Crossable watercourse <2 m
-  Minor water channel
-  Narrow marsh
-  Uncrossable marsh
-  Distinct marsh
-  Indistinct marsh
-  Well
-  Spring
-  Special water feature

-  Open land
-  Open land with scattered trees
-  Rough open land
-  Rough open land with scattered trees
-  Forest: easy running, 80 to 100%
-  Forest: slow running, 60 to 80%
-  Undergrowth: slow running, 60 to 80%
-  Forest: difficult to run, 20 to 60%
-  Undergrowth: difficult to run, 20 to 60%
-  Vegetation: impassable, 0 to 20%
-  Forest runnable in one direction
-  Orchard
-  Distinct cultivation boundary
-  Cultivated land
-  Distinct vegetation boundary
-  Indistinct vegetation boundary
-  Prominent large tree
-  Prominent bush or small tree
-  Prominent vegetation feature

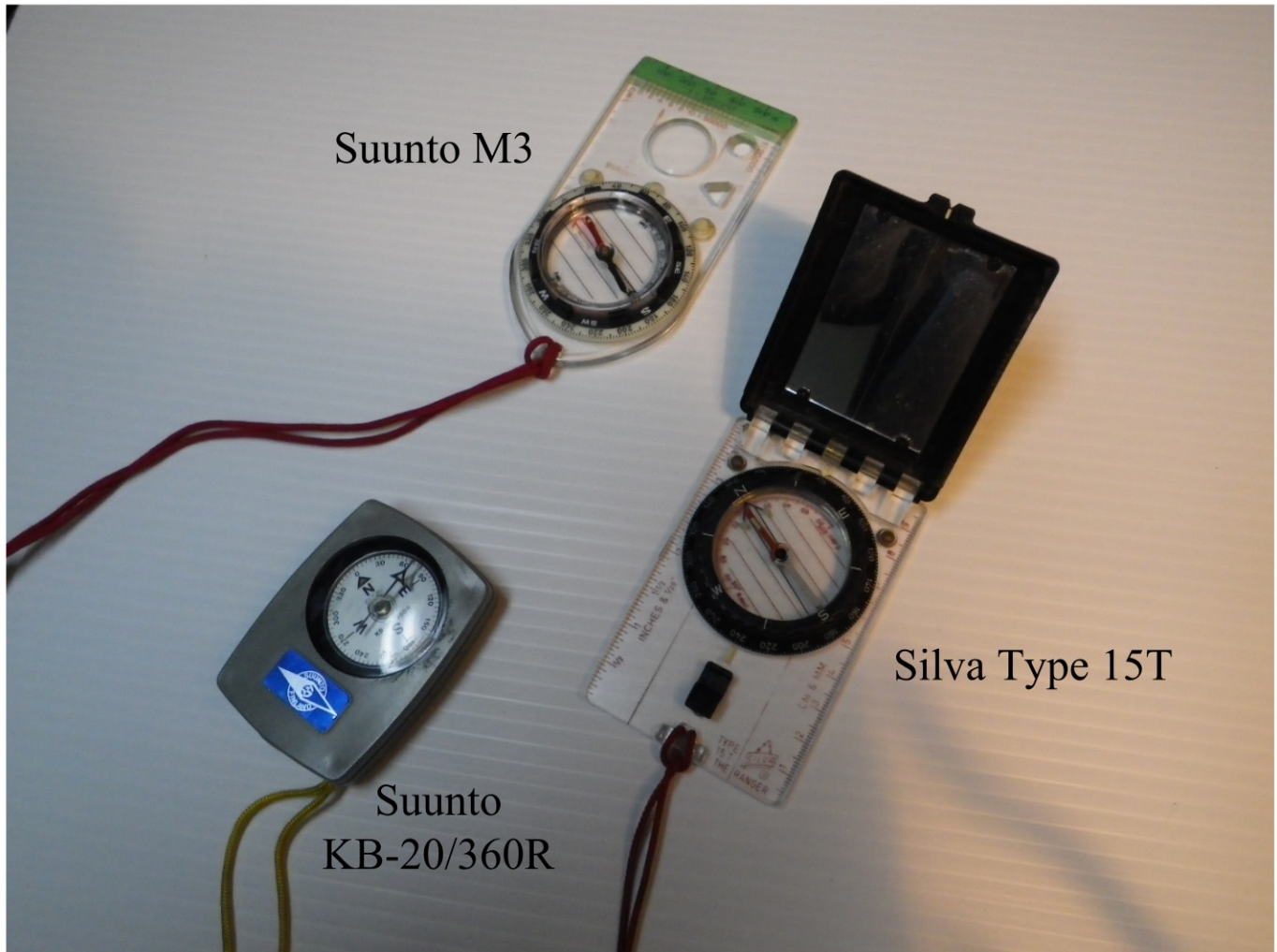
-  Divided highway
-  Major road
-  Minor road
-  Road
-  Vehicle track
-  Footpath
-  Unpaved footpath or track
-  Small unpaved path or track
-  Less distinct small path
-  Narrow ride
-  Power line
-  Major power line
-  Fence
-  Ruined fence
-  High fence
-  Settlement
-  Permanently out of bounds
-  Paved area
-  High tower
-  Small tower
-  Cairn, survey point

### A FIELD SURVEY LEGEND

(REF. Map Making for Orienteering by Malcolm Adams, 2nd ed. 2001)

These are symbols and codes for field survey drawing with pencils on mylar,  
or in an Open Orienteering Mapper scribble template.

## Examples of compasses



Suunto M3

Suunto  
KB-20/360R

Silva Type 15T

## Examples of GPS receivers

Garmin  
Etrex Legend  
2003



Garmin  
Etrex Vista  
2011



Qstarz  
818XT  
2013



Garmin  
GLO  
2017

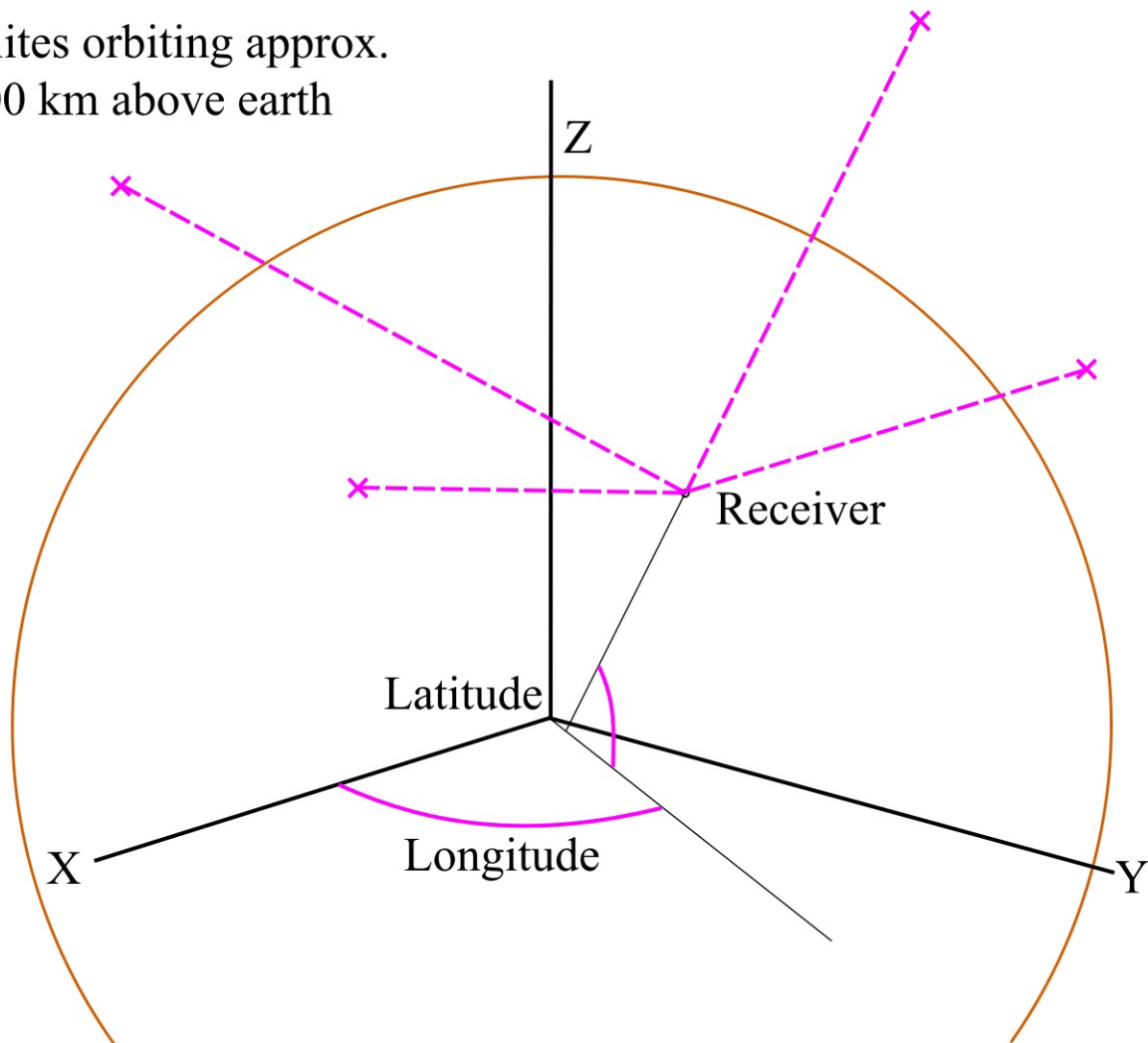


Sparkfun GPS-RTK2 2020



## A VERY SIMPLIFIED EXPLANATION OF GPS

Satellites orbiting approx.  
20,000 km above earth



Satellite coordinates at any point in time are "known" thanks to a network of ground tracking stations.

Satellites are equipped with very precise atomic clocks.

A satellite transmits a time-stamped radio message at  $t_1$ . The receiver gets the message at  $t_2$ . The range from the satellite to the receiver =  $(t_2 - t_1) \times \text{speed of light}$ .

Range measurements to at least four satellites are needed to solve for the receiver coordinates and the receiver clock error.

GPS stands for the Global Positioning System, originally developed for the U.S. military.

Other satellite navigation systems now include GLONASS (Russia), Beidou (China) and Galileo (European Union).

Factors which affect receiver accuracy:

- the number of satellites visible and their positions in the sky
- signal scattering by trees and buildings
- atmospheric conditions
- satellite orbit errors

Pushing for sub-metre accuracy:

Receivers that are sensitive to satellite signals in more than one frequency band can compensate for some of the atmospheric condition errors.

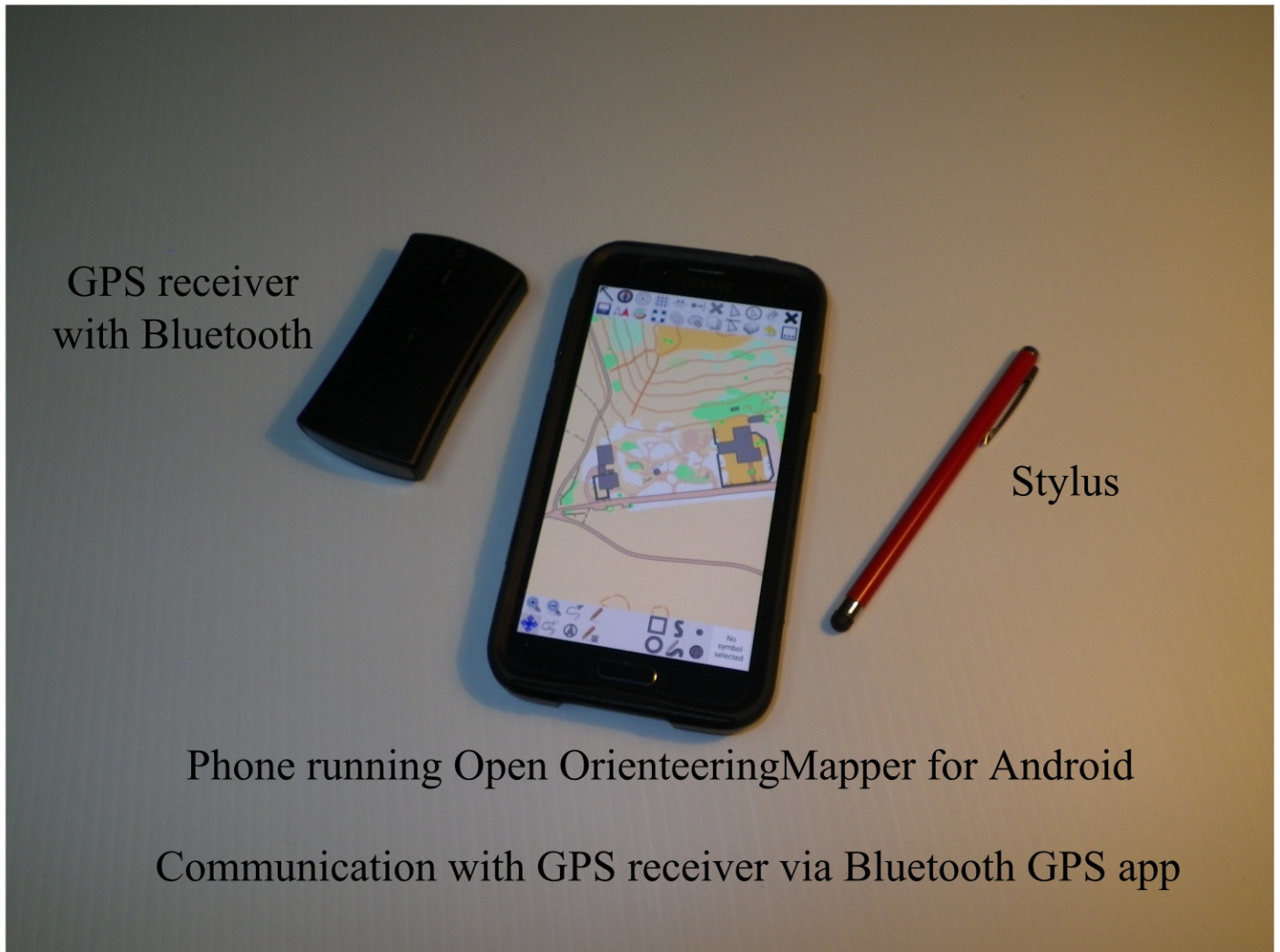
Differential GPS is a scheme that combines data from a base station receiver at a known location with data from a roving receiver, to correct errors in the rover coordinates.

The acronym RTK, for Real Time Kinematics, means that the corrections are applied in real time (not processed after the survey).

Communication between the base and rover can be with a dedicated radio link, or over wireless internet in areas that have cell phone coverage.



## Field survey with an Android cell phone



A phone battery lasts about 5 hours from full charge. Bring a USB power bank for recharging the phone.

Some mappers tape the GPS to their hat. Another idea is to mount it on a wand attached to your daypack.

## CELL PHONE CONNECTION TO EXTERNAL GPS

- Why use the external GPS?
1. More accurate than the phone GPS.
  2. Reduces load on the phone battery.

GPS receiver sends out navigation data by Bluetooth

\$GPGGA, etc



Another app to consider for "Mock Location Provider" is UltraGPS Logger. It has more features and settings.

Open O Mapper saves track points as fast as the receiver sends them. 10 points per second results in a very large track file after a few hours. 1 point per second is adequate.

Minor bug in Open O Mapper .gpx files: Time and elevation values are not always correct. Fortunately the latitude and longitude are correct.

Phone internal GPS switched off

Bluetooth GPS app is a "Mock Location Provider" reading the navigation data and making it available to the Android system.

Open O Mapper app shows a cursor at your present location and saves the track in a .gpx file

<trkpt lat= etc.

## TIPS FOR EXTERNAL RECEIVER CONNECTION

After Bluetooth pairing of the external GPS and the phone, and installing the Bluetooth GPS app, you need to identify Bluetooth GPS as the Mock Location Provider.

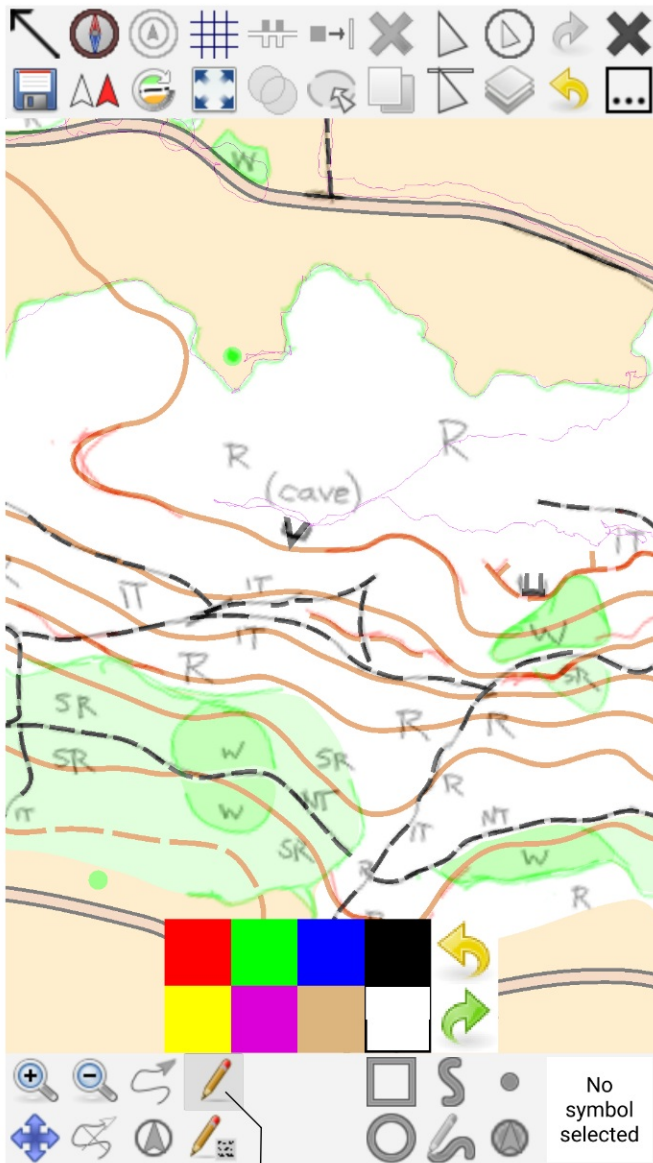
In the system settings of the phone, tap the "About phone" heading seven times to open Developer options.

Caution - Probably you don't want to change any of the developer options except to tap "Mock location app". Then you see a list of apps that could be the Mock Location Provider. Choose Bluetooth GPS, then use the Back button to exit.

Minor Android system bug: Even though you changed the Mock Location app, this might not be reflected on the Developer options screen.

# Open Orienteering Mapper (Android version) screen shots

## Scribble layer on



Tapping the pencil icon brings up the palette

## Scribble layer off



Highlight the GPS track so it's easier to trace



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**Olles Maps**

August 5, 2016 · 🌐

I now completely switched to digital orienteering mapping. I gathered some thoughts you may find helpful.

The transition was rather long and I tried different approaches. I started in 2011 with Fujitsu Windows tablet. In 2014 I purchased Sony Xperia tablet. Now I use LG G4 Stylus.

Between 2011 - 2015 I tried mapping with tablet here and there, but I was dissatisfied with it. The major disadvantages were clumsiness of Windows (that might have changed since 2011) and clumsiness of stylus. It did not make me more efficient.

That changed in 2016 😊 My old cell phone got broken and I decided to buy a bigger screen phone that can handle also mapping. I opted for LG G4 Stylus.

\* It has a built-in stylus - There are not many phones/ tablets in this category. The phone has to support thin point stylus input to work efficiently.

\* It runs Android and OpenOrienteeringMapper - Thank you so much OpenOrienteering guys! OOM is a wonderful (and free) program.

\* It has a 5,7 inch screen - That means I can easily hold it in one hand with no fatigue. And at the same time there is enough screen space to draw on.

\* Its battery can last 8-12 hours (depending on light conditions).

\* The price of the phone is very reasonable (150-200 EUR).

\* I can connect the phone via bluetooth with external GPS (Garmin Glo).

All in all I am very happy with the set up.

If you think I shall expand this article in describing how I use OpenOrienteeringMapper for fieldwork, let me know in comments.



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