

Geoff Peck's guide to geo-referencing o-maps – version 2, April 2010

Introduction

These notes are based on help from others (notably Craig Steffens) and my own experience and in no way should be taken as 'definitive' ... I just know it works fairly well (ie better than other methods!) using a Garmin Dakota and the maps I have geo-referenced so far, and used in the field. The most important thing to realise is that very few existing o-maps are absolutely accurate; few of our normal base maps were correctly geo-referenced in the first place! It is also important to state that absolute accuracy is not the Holy Grail it sure is useful if you want to use a GPS to assist with field work, but many existing o-maps which are not absolutely accurate are perfectly adequate for our sport because they are 'relatively' accurate; this is still the most important aspect of field-work. Some existing o-maps may contain significant absolute errors but remain perfectly usable, and the effort to geo-reference them may not be required, or may not be justifiable. It is also possible to geo-reference PART of an existing o-map to assist with field-work if it is not possible to geo-reference all of it.

Geo-referencing methods

There are several ways to geo-reference an o-map. OCAD recommend the use of topo maps (presumably because in Switzerland they are extremely accurate) but my experience of topo maps here is that they may contain bigger errors than the o-map! It is also possible (I have done it) to use Google Earth but I find this cumbersome and not very accurate ... see below. I think this method (thanks again, Craig) is the way to go; it's easy and makes sense to use the same technology throughout.

The recommended method

1. Go out and record some tracks round the area on your GPS unit. It is important (see below) to include unique, distinct points that you think will be accurate on the map (eg road/track junctions, open field boundaries etc) and not just vague paths etc. Best results are obtained if you pick these points at or near the four corners of the map, and include other points inside the boundaries. Personally, I do this on my MTB, also serving to establish/check the major tracks at the same time. Do NOT rely on one or two distinct points as they might both be wrong!
2. Open a new OCAD file. Before doing anything else, make sure that this file is:
 - a. The same scale as your o-map (remember to use 'change scale' to do this)
 - b. The same symbol set as your o-map (import symbols and colours)
3. Import the GPS track(s) (note you can import as many as you like, in a batch if desired)
 - a. Use GPS, import file
 - b. Select a symbol to 'assign symbols' (I use purple line)
 - c. Accept proposed co-ordinate system (UTM)
 - d. New offset ... accept proposed horiz/vert but set angle to reflect declination (usually 11 degrees in Brisbane area) ... this will rotate the geo-ref system to magnetic north so you don't have to rotate the map later (which can cause problems)
 - e. In OCAD 10 the import window doesn't close ... you need to close manually to complete the import process ... now you should now see wiggly purple line(s) and a UTM grid, rotated 11 degrees anti-clockwise :)
4. Now save this OCAD file (it can be used to import more GPS tracks when you do field work, so save it as something like xxx_map_GPS_tracks.ocd) but keep it open
5. Now import your existing OCAD map file into this file, using 'place with mouse' ... when it imports, try to move it with the mouse to approximately the right place on top of your purple GPS tracks and accept.
6. Now comes the tricky bit! Now you use Map, Transform Map to align the map with the GPS track(s) in a similar process to aligning a background map. The trick is to pick points on the map and GPS track which are EXACTLY the same. If you don't the map will not transform well. You can pick as many points as you want ... I recommend picking 3 or 4 near the edges of the map the first time. When complete (press enter) the map will try to transform to the co-ordinate system (you might notice it shift), moving your purple lines at the same time. So you now need to delete the purple

line(s) – select the symbol then use Map, Delete Objects by Symbol – then re-import the GPS tracks.

The easiest (?) way to do this is:

- a. Delete the purple line(s) as above
 - b. Save your transformed map as something new (eg xxx_map_georef.ocd)
 - c. Import the GPS tracks (your previous file xxx_map_GPS_tracks.ocd) using the Place with Offset (set to zero) to ensure it's georeferenced correctly
7. If all went well, importing the GPS tracks again will show the purple line(s) very close to what you want. In my experience, it rarely works 100% the first time, usually because one of your chosen map points wasn't accurate ... so you'll probably need to go through the process (ie repeat step 6 above) again, picking other points this time. It is usually fairly easy to see which point(s) were wrong as the GPS will look OK in parts of the map but not in others, but sometimes it takes a bit of detective work (perhaps cross-referencing to Google Earth or a topo map to see what might be wrong). Again, in my experience, you can't really rely on ANY of the existing o-map as even roads, fence boundaries might be wrong. If necessary, you may need to go back to the area to record some more GPS tracks to help with this process.
 8. It may not be possible to geo-reference all o-maps. However, it may be that the errors are confined to part(s) of the map and it is still worth geo-referencing the rest of the map to assist with field-work. The advantage of this system of geo-referencing is that the mapper will be aware of which bits of the map can be used for GPS mapping and which bits are unsuitable.
 9. When you are happy (?) with the geo-referenced o-map then you can save it again, and also export it as a kmz file (OCAD 10 only) and import into your Garmin ... this is very easy on the Dakota ... then use it to assist with field work. It is best to export the kmz file with (some of) the purple GPS tracks visible too, to assist with field work. In an ideal world, the Garmin position will be 100% accurate on the imported o-map, but it is worth emphasising that:
 - a. It will only be accurate on the o-map in the areas that were correct. If any areas were wrong, you will have a purple GPS track to help fix it in the field :)
 - b. It will only be accurate if you have geo-referenced **very** accurately above
 - c. It will only be accurate if it's getting good GPS data. You can get a rough check on this from the Garmin itself before relying on the data, but you have no idea about distortion from sunspots etc, and you need to remember that dense tree cover and tall buildings will always block/distort the signals ... the GPS will still show position and tracks but using an algorithm to 'predict' your position from the your last direction and speed until it picks up a good signal again so beware!
 - d. Even in good conditions, it is unlikely to be much better than +/- 10m (even though the GPS may claim less) so do NOT use it to plot features close together ... but it IS great to sort out tracks systems, establish position in vague featureless areas etc
 10. Every time you go out and use the GPS for field work, you can import the tracks into your master file (eg xxx_map_GPS_tracks.ocd) and/or import directly into your geo-referenced map without the need for further adjustment ... once it is georeferenced, you can record a new track on the GPS, import into the o-map, change symbol to track, and it's there. You can also import waypoints in the same way (certainly from a Garmin Dakota) and place them in the map, always remembering the 10m circle of error.

As this is still a draft and I haven't had that much experience yet, any comments/feedback would be much appreciated.

Good luck, Geoff Peck
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Note: there is also a help video of the Transform Map function via the Help menu in OCAD 10 (or their website).