

Mapping with OCAD and real time GPS

Abstract

This document describes the data sources and mapping techniques used to prepare the Saddleback map for the 2018 NSW middle and long distance championships. In particular it details the use of OCAD in the field with live GPS to accurately position all features on the map.

Introduction

Plans for mapping the Mount Brown/Saddleback area go back more than 12 years when aerial photographs at a scale of 1:10 000 were flown in 2006. Unfortunately the angle the photos were taken at was outside the range of adjustment of the photogrammetry equipment and it was therefore necessary to resort to 1:50 000 photos of a limited section of the area. The resulting photogrammetry of the Mount Brown section was used by Eric Andrews for the 2010 Xmas 5 days map. This was done using conventional mapping techniques of coloured pencils and drawing film in the field for later copying into OCAD.

Further mapping of the area was put off when a change of landowner in the northeastern part of the area created access difficulties, but then another change of ownership in about 2015 resulted in access being possible once more.

In the meantime, a contact had been established with the Department of Environment and Heritage in Grafton who were able to provide imagery with 5 metre contours generated electronically from their database of aerial photos. Although there were sometimes gross inaccuracies in the contours on steep south facing slopes where the photos were in shadow, the results were generally quite acceptable and comparable to those obtained with manual photogrammetry.

Also Eric was continuing to pioneer new mapping techniques and had acquired a ruggedised tablet PC with OCAD, coupled via Bluetooth to a sensitive GPS receiver that showed the mapper's location on the map in real time. This allowed mapping directly with OCAD in the field thus making the positioning of objects much more accurate.

Following Eric's passing in 2016, Northern Tablelands OC was offered the opportunity to acquire his equipment and this has proved invaluable.

Equipment details

Tablet PC

Motion Computing PC F5m, with stylus and Windows 7

Spare battery – hot swappable. Each battery lasts about 4 hours depending on screen brightness (web site says 8 hours)

OCAD 12 orienteering version

GPS receiver

Garmin GLO. This unit uses the Russian GLONASS satellites as well as the US GPS system. Response time is very fast and accuracy is usually within 3 metres, even under tree cover (though deep gorges may be a different matter). Battery life is said to be up to 12 hours but this has never been put to the test.

Baseboard

The weight of the tablet PC is such that it is rather uncomfortable to carry for any length of time without some sort of support so a simple baseboard and harness was constructed to take the weight. The baseboard comprises two pieces of plywood connected by a brass stud to form a simple turntable; the top piece (on which the tablet sits) is the same size as the tablet and has a small piece of wood glued to it to prevent the tablet from sliding about. The bottom piece of ply is somewhat larger and has a compass and the GPS receiver attached to it with blu-tack. Shoulders straps are provided by two long shoelaces secured to opposite corners of the bottom piece of ply.

The purpose of the turntable is to allow the tablet and OCAD map to be rotated and aligned to north regardless of which way the mapper is facing.



Figure 1: Tablet PC mounted on baseboard

Map setup

Orienteering maps by convention have magnetic north aligned with the edge of the paper. On the other hand imagery and other data obtained from government and other sources are usually aligned with the UTM grid for the relevant zone. The

OCAD makes it possible to have the map geo-referenced and at the same time to have it rotated to magnetic north. The following is an idealised summary of the procedure used to geo-reference the map in OCAD (version 10 or later is required).

1. Identify features at the extremities of the map that are clearly visible on the imagery. Gravel roads and dams are good candidates. Obtain GPS data in the field for these features and save the data as a gpx file.
2. Create a new OCAD map file and set the map Angle to the local grid magnetic angle (under Map > Scale and Coordinate System ... > Real-world coordinates – no need to worry about offsets and coordinate system at this stage; they will be set later).
The grid magnetic angle can be obtained by correcting the magnetic deviation from <http://www.ga.gov.au/oracle/geomag/agrfform.jsp> for grid convergence, or more simply from <http://www.remmaps.it/mag/>, which gives the Grid Magnetic Angle (OCAD Angle) directly via a clickable map.
3. Import the gpx file (GPS > Import from File ...). This will automatically set the coordinate system and offsets. Change tracks and waypoints to suitable OCAD symbols and save the file as mapname-gps.ocd.
4. Create another new OCAD map file (this will be the actual map)
Load mapname-gps.ocd and as a background (again the coordinate system and offsets will be set automatically)
Load the imagery as a background and adjust it to the gps data using the prominent features.

In practice, because the map is an extension of the existing Mount Brown map, the procedure was not quite as described above. In fact the Mount Brown map was already geo-referenced so it was only necessary to check the accuracy of this and to load and adjust the background imagery supplied by the Department of Environment and Heritage.

Handling contours

The contours supplied by the Department of Environment and Heritage were included as part of the aerial image file so it was necessary to trace these into OCAD using a temporary draft contour symbol so they could be displayed independently of the photographic imagery.



Figure 2: Sample of imagery as supplied



Figure 3: Draft contours (rotated to mag north)

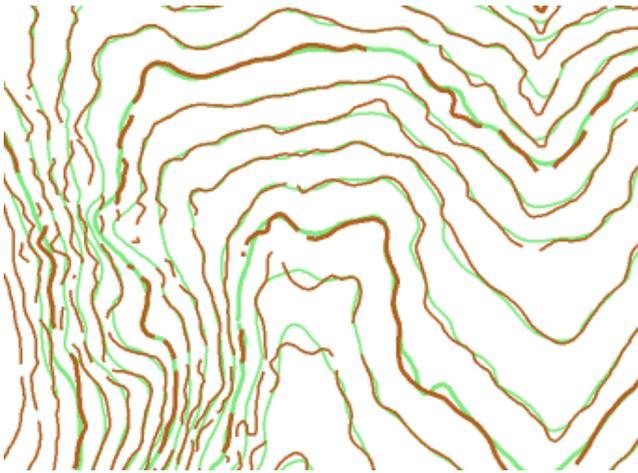


Figure 4: Field-worked + draft contours

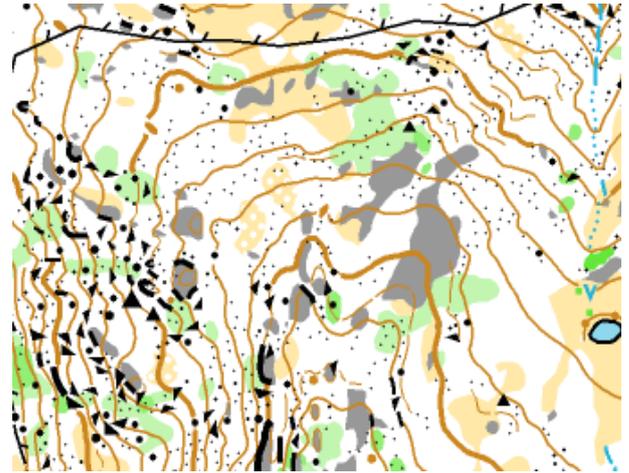


Figure 5: Final map

Field-working techniques

Linear features

Tracks and watercourses were generally mapped by selecting the appropriate symbol and walking the feature with live tracking turned on. This inevitably gives a line with far too many points and can often be rather jerky. This can be fixed either by smoothing the line or by converting from a poly line to a bezier curve. Fences were done by going to each corner point and joining them with straight lines.

Area features

Large areas of rock, vegetation and clearings were done either by tracing the boundaries as for linear features, or by walking close to the boundary and drawing with the stylus. Small areas were done by standing adjacent to the feature and drawing by eye with the stylus.

Point features

Boulders and other point features were drawn by standing next to the feature and placing it with the stylus, taking care to ensure that alignment of nearby features was correct.

Drawing in the field with a stylus can be a little imprecise, especially for linear features, so it is usually necessary to spend an hour or so at home after a day in the field tidying up some of the detail.

Map layers

In order to print the final course maps at 2 different scales (1:10 000 and 1:7500) and to fit each course map onto a single sheet, numerous layouts were required. Rather than duplicate the map detail in each layout, the layout information was kept separate from the master map. The master map contained only the map itself with no title, legend or other text or logos. All of this supplementary information was contained in the layout files, which in turn used the master map as a background to display the map detail.

Logos in the form of raster images were included in the layout files not as backgrounds (which prior to OCAD 11 was the only option) but by using OCAD 12's Layout > Edit Layout Objects function. This allows all vector objects to be exported as such to a pdf file rather than converting ALL background data to raster form as happens if ANY of the background data is in raster form.

Rock interpretation

Three 1.5 m boulders, 15 m apart and partly obscured by long grass, could not be mapped as such because they were dwarfed by a 5 m boulder in the foreground and more large rock hidden in the green in the background. Instead they are mapped as large rocky ground.

