BOF Mapping Conference 2004

Report

Erik's plastic contours!

Lilleshall National Sports Centre,
Lilleshall, Shropshire

22 - 24 October 2004

National Mapping Conference 2004

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Instructors:

Erik Peckett	DEVON	(BOF Map Group Chairman)
Roger Lott	TVOC	
Rod Postlethwaite	WRE	
Peter Roberts	EBOR	(Organiser)

Participants:

Lew Bean	DEVON	
Bill Brown	WSX	
John Crosby	NATO	
Robert Dove	SMOC	
Pat Flanagan	CUNOC	
Paul Frost	ECKO & SO	
Mike George	NOR	
Alan Heppenstall	LOC	
Colin Hicks	SOC	
David Olivant	NOC	
John Parfitt	SARUM	
Charlie Richardson	SOC	
Colin Spears	HOC	(Saturday only)
Brian Hughes	HOC	(Saturday only)

Outline Programme:

Friday

Introductions

Saturday

Mapping Exercise in Short Woods
Drawing survey exercise, survey presentation and simplification
Cartography techniques

Sunday

GPS demonstration in Lilleshall grounds
Distance measuring devices
Miscellaneous discussions

Introduction:

The Conference was organised by Peter Roberts (EBOR) on behalf of the BOF Map Group with assistance from Erik Peckett (DEVON) and Rod Postlethwaite (WRE).

Attendees were encouraged to participate and share their views constructively thoughout the procedures.

The theme that ran through the Conference was that the quality, i.e. the usefulness, of maps was enhanced by compliance with the ISOM 2000 specifications. With the advent of freeware versions of OCAD, it was recognised that more mappers were becoming involved at club level and a more active approach would be needed to maintain and raise mapping standards.

The Map Group were developing a strategy to ensure that all aspiring mappers would be actively taught the basic surveying and drawing standards which would ensure that respect for the standards was achieved by comprehension not by imposition. Existing mappers, who were largely self-taught, would need encouragement to adopt the same approach.

Mapping Exercise at Short Woods:

Short Woods is a complex pitted area measuring 600x500 metres, formed by coal mining, which forms part of the Wrekin Orienteers' map of The Wrekin. It has previously been mapped in 1979 and 1992. Participants were provided with a copy of a photogrammetric plot, a copy of an aerial photograph and a copy of the 1979 map, which included the entire myriad of pits and knolls. All the materials provided were at a 1:7500 scale.

The main issue was the survey simplification of complex areas. Cluttered maps are difficult to use and waste the potential of that such areas. An 'O' map is not intended to be a faithful record of every feature of the terrain but a selection of the prominent features which the running competitor could both notice and use to assist navigation decisions.

The features selected depended on the nature of the terrain and the size of symbols on the map, i,e. scale related as well as prominence. The resultant maps showed that we all need to be very selective with features, retaining only the most prominent to avoid the heavy clutter which was obvious on the 1979 'O' map of the area. This meant leaving off many pits and depressions in favour of showing prominent contour features.

This is how big a pit is on the map

In two exercises Erik Peckett demonstrated the, surprisingly, large size of symbols on the map when drawn on the ground. A pit symbol occupied an area of 11 x 12 metres and contour lines were strips of plastic 2 metres wide! This brought home the futility of individually mapping closely spaced pits, rootstocks etc.

An actual example of a line of deep but closely spaced pits was examined. The conclusion was that, if they were significant enough to be included on the map, the first and last could be shown with broken ground between them.

The IOF rule is that the minimum line spacing of similar lines on a map is 1.5mm. Erik showed that a quite steep, 15m high bank could be adequately represented by the, preferred, method of drawing contours suitably close together rather than by the earth bank 'comb' symbol, which should only be used if the contour lines would otherwise be closer than the allowed minimum. Erik confirmed that an earlier Controllers Conference had agreed that this bank, when shown by tight contour lines, would be a valid control site. Competitors and Planners would have to be educated on this point, quite apart from Mappers.

Recommended Mapping Process

- Survey all standard O-maps at 1:7500.
- On the survey, draw with OCAD sized symbols to exclude unnecessary clutter.
- Use the 1:15000 symbol set in OCAD and print at 1:15000
- For 1:10000 maps, do the same but print at 1:10000. (Everything, therefore, including symbols, is scaled to 150%).
- Surveying only at 1:7500 as this will limit the content as you walk round which in turn makes for a easier to read map for the running competitor. Historically many mappers survey at 1:5000 or even larger - this is not encouraged. Why 1:7500? This has been recommended by IOF for many years and equates to twice the preferred map scale of 1:15000. It means the survey content is the same when drawn at both 1:15,000 and 1:10,000. The only difference is the size of the symbols.
- For the design and layout of the map, consider Jon Sutcliffe's paper (Appendix A page 7).
- Do the Map Group self-assessment of the map before submission or ask your best friend to do it for your map. The purpose is for you to check the completeness of the cartography in relation to the known practice and IOF specifications.

The finished map is to be used for someone **RUNNING** round a course and their needs to be enough information on the map for them to be able to navigate and find the controls.

Mapping Training

The Map Group is seeking support in the Regions from people who would organise venues etc. for Mapping Training Courses for which the Map Group would supply Speakers/Instructors. In this way it was hoped to formally train the next generation of mappers into a more consistent approach, which also complied with the IOF specifications.

Design and Layout of Maps

A paper on this topic from Jonathan Sutcliffe was given to the delegates (Appendix A page 7).

OCAD Features

Rod reviewed all the tool buttons on the OCAD tool bar and covered several other OCAD related issues (See Appendix C page 12).

OCAD Training , Tips and Helpline

There was a need for a document to provide introductory training for newcomers to OCAD, especially as more widespread use was being made of the freeware OCAD 6. Very few users appeared to have access to the small Beginner's Handbook, which comes with purchased copies of OCAD. In addition there would be value in collecting together more advanced tips

for using OCAD. This was in addition to the OCAD Help Line already offered through the Map Group by Bruce Bryant (ocad.help@virgin.net).

Bill Brown & Roger Lott offered to see if something practical could be produced for Beginner Training And Advanced Tips. These would be made available through the Map Group web site.

Use of GPS for 'O' Maps

Roger Lott (TVOC) gave an excellent PowerPoint introduction to the principles and practicalities of GPS (Appendix B page 10) in 'O' Mapping. He had found that certain hand-held GPS units (costing about £180) could make a positive contribution to the surveying task provided the constraints of getting reliable data from GPS were observed.

GPS was eminently suitable for areas with no tree cover, giving positions to about 5 metres (95%) accuracy. In heavily forested areas, GPS could be applied to fixing the position of the perimeter features and wider track intersections within the area. Other points within the area might also be possible if the conditions are favourable.

GPS was especially valuable with school maps where the main task was positioning point features, which were not on the existing base maps of the school.

He demonstrated one unit (Marin GPS III+, now superseded by IV, V etc) which he found satisfactory and several cheaper ones, which were not adequate for orienteering maps. A test around the Lilleshall grounds with GPSIII+ gave a difference between two readings at the same spot separated by 30 minutes of 1m in Latitude and 7m in Longitude.

Distance Measuring Devices

Rod Postlethwaite and Peter Roberts showed several range finders. They were called a laser ranger but there was no visible beam and it possibly worked in the infrared range. This was an ex-golfers' device which cost about £300 new and £180 second hand (Ebay). They have a working range of 20m -400m. On clean, solid targets it worked well. It was said that care had to be taken in forests to avoid spurious reflections from intermediate leaves or trees, as the ranging beam spreads out away from the user.
Supplier's names: Bushnell and JJ Vickers, Chatham.

Other OCAD related Matters:

In OCAD 8 Erik Peckett reported that the template can move slightly when re-opened.

Sources of Base Maps

GetMapping:
Aerial photographs by County on CD-ROM. These cost approximately £20 each or 2 for £30. Some distortion may be present so there is the need for a good base map to fit to. Web site: http://www.getmapping.com/

Photomap:
Hardcopy maps with streets overlaid in white. Web site: http://www.photomap.co.uk

OS Landline:
Details off OS web site: http://www.ordnancesurvey.co.uk

Don Scarrott OCAD Utilities

Don Scarrott (WCOC) offers a download of a set of utilities (Shareware) giving useful OCAD facilities such as extracting all purple from a map. This allows one to send a base map plus several sets of purple to a printer rather than several full maps. Email request to Don at: dscarrott@aol.com

Spacing of Magnetic North Lines

ISOM 2000 states that this should be 500 metres at 1:15000, 250 metres at 1:10000 and 20mm – 40mm spacing, on paper, for larger scales.

14. Miscellaneous

- Colour laser printers are becoming affordable while offering adequate resolution for map printing. There are many available in this price range, an example of which was demonstrated: Lexmark Colour Laser Printer. Cost £320, 4 colour cartridges. Replacement £59 each. Approx 10 A4 colour copies per minute

- OCAD maps can be converted to pdf format by use of the utility pdf995 which can be downloaded from www.pdf995.com. This gives a version which has 'pop-up' adverts. It cost $9 for an advert-free version.

- It was announced that BOF are developing an online forum for discussing 'O' topics.

- It was pointed out that more maps these days have no legends either because they are at 1:10000 and have been made the lazy way by simply expanding a part of a 1:15000 map or because there is no room on the sheet. This appears to disadvantage those who are more likely to need the legend i.e. those on beginners' courses. The copyright statements are also frequently missing from 1:10000 maps due to the expansion process.

- It was stated that legends should be available to the competitor but not necessarily on the map. Special and non-BOF symbols must be defined on every version of the map. Some clubs regularly make separate printed legends available.

Report complied by Rod Postlethwaite (WRE) from notes by Bill Brown (WSX) with additional material from Peter Roberts.

Map Design for Orienteers

What's the point? How important is it?

Map design is all about the peripheral information around the map & how it's shown. Whilst some of the stuff around the map is critical, there is no hard and fast rule about how much information is shown. Much depends on the amount of space available & the intended use of the map. This is because the needs, in terms of map layout & peripheral information mean different things to different users:

1. **To the seasoned orienteer** - it has limited use, to be honest. Competitive orienteers will need to know the scale/contour interval but beyond that, they should be familiar with the meaning of the map symbols. They shouldn't need to refer to the key, so just pick up the map & go.
2. **To the beginner** - it has much higher importance. Presenting information clearly allows it to be taken in quickly and more efficiently.
3. **To the PR people in our sport** - a good map layout, like good graphic design in all sporting publicity, will create lasting impressions. We compete against other sports in gaining the attention of potential participants, usually with tighter budgets. Maps are our vehicle, so they need to look good.
4. **To the mapper** - it's really a matter of pride. In creating a map, we create a work of art. Of course, we all like praise to reflect our effort. It's nice to hang finished maps on the wall & have them admired. But first we need to know how.

Art or Science?

Like graphic design and paintings, good effective composition can be achieved by following some rules. These rules imply the process is a **science,** and following them should achieve success. On the other hand, sometimes rules can be broken. Knowing when is the **art.** Probably the best map layouts are made exceptional when a cartographer demonstrates an ability to add flair to set rules of design.

Who's Opinions count?

The answer to that is *everyone's.* And, of course, every opinion has equal weight. I wish to make it clear that these are just my rules and my thoughts, compiled from years I have spent working as a professional cartographer. I think they work well but I know that not everyone will agree. All I suggest to fellow mappers is that you consider the issues, apply them if you are happy to do so, but if not, try to consider, formulate and apply your alternatives.

Map design is important!!

The Rules

1. Fonts

A common failing in newsletter design is the overwhelming urge to use every font available in the program. Most design textbooks will recommend restricting me use of fonts. Try to use no more than 2 fonts (excluding text in logos). I use a serif and sans serif font to give good contrast but, again, page layout textbooks will offer suggestions on which fonts work well together. Some are good for headings, some for displays & others merely for body text. I use the Serif font for titles and the simpler Sans serif (Arial or Helvetica) for small text.

2. Hierarchy of Information

To many this is basic stuff, but I still see maps where the hierarchy is unclear. You need to establish what the most important information is, then represent it as such in the larger text. I would suggest the order should be (from largest to smallest):
Title > scale/contour interval > key text > credits

3. Visual Balance

This is an awkward one to explain. It's something that most people do naturally, and is all about balancing the map image with text, within the paper. When I'm doing a layout, I position the map along side map borders where there is the least dead space created. The titles & key are placed on the other vertical (where possible) of the border in such a way as to balance the map. Because they take up less area they can appear to have less prominence but by being given stronger colours (or tints of colour), this balance can be addressed. On smaller maps, particularly where lots of symbols are used, the opposite applies and so I'd therefore tone down the text, both in terms of size and colour density.

4. Choice of Colour

Colour is an important consideration. The last section (Visual Balance) may influence the type or density of colour but, normally, my main consideration is to use complimentary colours. I adopt one of two plans.

- Plan A: I match colours to a club or school logo. I pull out the major colour and use that for borders or text colouring.

- Plan B: I look for the mapped area's most dominant colour and use this as a basis for colour combinations.

Once I have established one main colour, 1 may want to balance that with a complimentary colour. Books about graphic design will have lots to say about this. By using a 'colour wheel', you can match colours from opposite ends of the spectrum. For instance, green goes with purple, and blue go with orangey yellow - this why my logo is blue & orangey yellow.

So, for example, if I have an area, which is predominantly open (ie yellow), I will try to use blue as my border.

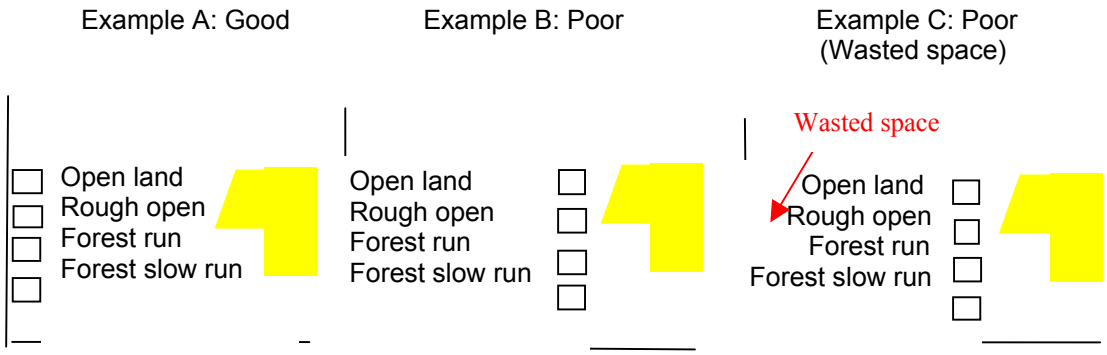
5. Alignment of Text

This also links to the section on Visual Balance. It follows on in the mechanics of where everything goes in the layout. When I know which side of the map the bulk of the text is going, I align the text to the adjacent part of the border (i.e. align left to the left hand part of the frame or vice versa).

The symbols are first placed in neat columns, next to the border. Text then aligns to both symbols and the border. This method means that text is always adjacent to their respective symbol - aligning away can be very difficult to use, particular when, in competition you may need to refer to them at speed.

6. Breathing Space

This alignment of text has another purpose. The opposite side of the text block, which is more, is next to the map. The map needs room to breathe - so you don't want text to be too close. This is difficult to achieve if you do not align text accordingly. For example, if text is aligned towards the map, irregular blank space is created between text & border. Here the space is completely wasted.



7. Using a Grid

Finally, one last thing that I feel is of the utmost importance - that is using a grid to create your layout. In programmes such as Adobe Illustrator, this is easy to do. These programmes allow you to position a grid carefully and 'snap' lines to it. By default the grid doesn't print so lining things up is quick and easy.

However, in OCAD we have to do the setting up manually. I create vertical & horizontal lines using the purple course overprint symbol. These are positioned say 4mm from the map border, all round the map. All text and graphics are then placed so as to butt up to these lines. This means there is a consistent gap between the border & other elements of the map layout. Once everything is properly laid out, I delete all the purple lines to leave the final map.

I hope these recommendations help steer you towards greater satisfaction with map layouts. If you have any comments or questions on this issue, please feel free to drop me a line, to my email address (below).

Jonathan Sutcliffe
SutMap: Bush Walking, Orienteering & General Purpose Mapping
Email: jon.@sutmap.com **Web:** www.sutmap.com

Appendix B GPS and 'O' Mapping (Roger Lott)

GPS and 'O' Mapping

1. Background

GPS (Global Positioning System) is a USA system, which is based on a set of 24 satellites equally spaced in 6 semi-stationary orbits around the earth. This ensures that at least 4 satellites are above the horizon, and in favourable positions, at all times, to most places on earth except towards the Polar Regions. GPS is a military system, which offers the same accuracy to military and civilian users, but accuracy to civilian users may be restricted in times of conflict.

The European Galileo system will be functional in 2008. This is a civilian system and will have the same accuracy potential as GPS. The two systems will be interoperable, at some expense.

The GPS system offers two services: accurate time and signals from which accurate global position can be derived. The accuracy of a position fix is a function of the quality of receiver used. At one extreme accuracy of 2 cm can be achieved but the £100 hand held device may give only 30 metre accuracy.

'Accuracy' refers to the diameter of the circle around the true position in which 95% of measurements fall. (In the UK, 1 second of Latitude represents 30m on the ground and 15m for Longitude)

A GPS receiver selects from the satellites it can see, the 4 with the strongest signals. It accepts information, which allows it to accurately calculate the position of each satellite at any time. It also receives a timing signal from each satellite which gives the exact time at which is was transmitted. All satellites are synchronised by ground control stations to Universal Time. The GPS receiver has a lower accuracy internal clock which times the instant of reception of the signals. But the clock has an unknown timing error. The software in the receiver now solves four simultaneous equations to provide the values of the four unknowns i.e. the 4 distances to the satellites and the time error in the receiver. From these distances the position of the receiver can be fixed in terms of Latitude, Longitude & Altitude. Cheaper receivers assume sea level to get a quicker calculation, which may introduce errors of 10-100 metres in location.

At the same time, if the receiver is moving, successive fixes allow it to determine its own speed and direction.

Even if the receiver has full visibility of the sky the actual positions of the satellites (geometry) at the time of the fix affects the accuracy obtained. Every location has 1-2 hours of optimum geometry each day, at a time of day, which varies slowly from day-to-day. The optimum periods can be obtained in advance from the Internet.

2. Choice of Receiver for 'O' Mapping

Suppliers tend to market their devices by using the same hardware modules in each model but differentiating them in the power of the software installed, which may significantly affect the accuracy obtained. There is a breakpoint below which it is not worth buying but neither retailer nor handbook will be able to supply the information on which to judge. In the Garmin range, the (superseded) model GPSIII+ was found to be reasonable. Three years ago this was about £80 more in cost than the basic models (£100). The GPSIV and V models are thought to use identical core hardware and software to III but to have fancier user interfaces.

Only buy models which do not assume an altitude of zero in their solution and which offer DOP (not EPE) as a quality measure (see below).

3. Use and Operation

With care and with good visibility, an accuracy of 5 metres can be obtained (20m under trees). This is quite adequate for fixing the boundary points of an area, for the major path intersections and for point features in the open. (Avoid microwave masts and tennis courts as these can upset the receiver. Power lines and pylons appear to have no effect)

These key points should be surveyed during the period of optimum geometry and two samples should be taken at 20-30 min interval. This data is saved in the receiver against 'waymark numbers', which have to be noted down. The information is then downloaded into a PC and processed to positional fixes using the supplier's software. It is suggested that this part of the survey is completed, entered into OCAD together with any other GPS survey data. Only then is the OCAD plot re-orientated to magnetic north to allow any foot survey information to be entered.

Quality indices are provided on the receiver to get the best results.

Speed: Wait until this settles to zero before taking a position reading.
Height (Altitude): This has, at best, an error 50% bigger than positional error.
Wait until height reading settles to steady value.
DOP (Dilution of Precision):
A quality score on the positional accuracy. Ideally = 1.
Position reading is unreliable if DOP is greater than 3.
EPE (Estimated Postion Error):
A quality score on the positional accuracy in cheaper receivers.
Do not buy a receiver with only EPE.

4. Aerial

It is difficult to hold the receiver up at arm's length in tree cover (to better see the satellites) and, at the same time, to read the receiver. A receiver is recommended which has provision for a remote aerial on a lead. This aerial can be paced on the head under a cap for convenience of use.

5. Batteries

These can give about 3 days use.

6. Experience With School Maps

Most local education authorities can supply detailed school drawings in .DFX format (This is a vector format), which can be imported into OCAD, so fixing the site boundary and buildings. A few hours with a GPS receiver can fix any additional point objects on the map and the job is done.

7. Future

Prices of good receivers will continue to fall in the future. Also the Ordnance Survey are creating a network of 750 base stations for internal use for differential positional fixes. This provides for a cheaper approach to using the GPS for very accurate fixes. Maybe in the future the general public may be able to get access to this system also.

8. Conclusion

Providing care is taken in selection of receiver, GPS can today make a very useful contribution to 'O' mapping.

OCAD Features & Tips

- Bezier curves: obtained using the Curve Mode drawing tool. The last two points are always available for better adjustment to the target curve. This may reduce overall 'tuning' of a line after tracing.

- Number of OCAD objects in map: Help > Map Information.

- Parallel tool: e.g. ditch along curving hedge. Create ditch by following along hedge line using the ctrl key. Click Parallel tool and drag ditch away from hedge. Ditch will be adjusted to remain parallel to hedge. This also works with the circular, ellipse and rectangular drawing tools in both line and area modes.

- Measure: To determine the length of a line or size of an area > Select line or area and click on Measure tool.

- To plot lines of given length & angle. Using Straight or Freehand drawing tools, double click at start point of line. Respond to dialogue box.

- Lines/Shapes constrained to 0 or 90 degree angle. Select straight line drawing tool. Draw with Alt key held down and the line will be constrained.

- Reducing Length of straight or curved lines: Select line. Select Normal Point tool. Click on line where should end. Select Remove Point tool & click on the unwanted end point and any other points until only target end point left.

- Including .gif or .jpg image (e.g. school logo) in an OCAD map:

    a. Open the image file in OCAD as a template behind map. Move & adjust template size until in correct position on map, print map with template still visible. Data size of template plus map will be large.

    b. Open the image as a template, as in (a) above. Trace the logo into the map.

- Replacing the Symbol Set of an existing map with an updated Symbol Set (Erik Peckett)

    a. Open a blank map containing the new Symbol set. Import the existing map into the blank map with zero offset. Those old symbols not matching in symbol number to a new symbol will appear at the bottom of the symbol table.

    b. Select all the new symbols in the symbol table and do: Symbol > Hide. The objects now visible in the map will be those corresponding to the old unmatched symbols at the bottom of the symbol table.

    c. Select an object in the map. Find and select the corresponding symbol to it in the upper part of the table. Usually the two symbol numbers before the decimal point will match. Do: Extras > Change Symbol and the corresponding objects on the map will disappear.

Appendix D The Mapping Exercise

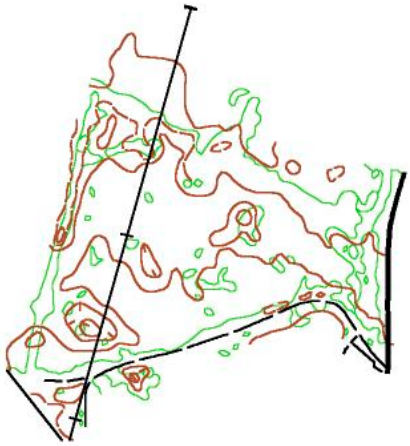


Fig. 1 Photogrammetric Plot

Fig. 2 1979 Survey

Fig.3 A good solution?

(Power Line omitted for the sake of clarity)

Cartography by Rod Postlethwaite (Wrekin Orienteers) 2004.

Above are shown the photogrammetric plot, the original 1979 survey with 10 metre contours and a recent survey, which provides a good solution to the generalisation question. Whilst there can be no definitive solution as survey is always open to interpretation, the final map provides a good picture of the terrain, reflecting the major features for navigation whilst also affording a selection of good control sites for the Planner.
The 1979 survey shows every single feature faithfully but ultimately fails to deliver a map that is usable.