



BRECON NAVIGATION HANDBOOK

INTRODUCTION

This guide is aimed at NCOs and officers attending courses at the Infantry Battle School Wales and at staff conducting pre-course training. At Brecon, all students are expected to be able to navigate, by day and by night, using a map and compass only. In the later stages of the course they will be permitted to use GPS. Student navigation skills at Brecon are habitually poor and Army map reading training goes little further than basic map reading and compass work. This booklet is designed to provide advice for prospective students on further navigational techniques. They have practical utility on a dark hillside in the rain and, when GPS fails, are the reversionary mode.

This guide assumes an understanding of the following:

- Map symbols on a 1:25,000 and 1:50,000 OS map.
- Map scale and measuring distance
- Contours, slopes and landforms
- Taking a compass bearing
- Adding/subtracting magnetic variation

If revision is needed, The Infantry Basic Map Reading Handbook 2003 is available through SO3 TDT, HQ DINF on 94 381 2720

10 CARDINAL RULES OF MILITARY NAVIGATION

1. Orientate the map whenever you check your position.
2. Keep legs between known points short.
3. Learn by heart how many double paces you take over 100m.
4. Trust your compass, not your instinct.
5. Use the contours.
6. Anticipate – know what is coming next and check that it does.
7. Take time to get your compass bearing accurate.
8. Prove your position by gathering evidence.

9. If lost or uncertain – Stop and think; don't move off until you have a clear plan of action.
10. Avoid obvious handrails or waypoints.

ORIENTATING THE MAP

Using a Compass



Place your compass horizontally onto the map, with the magnetic needle pointing north. Don't worry about lining up the lubber lines on the bezel, or lining up the compass edge at this stage – it's the needle that matters. Don't worry about magnetic variation at this stage either.

Turn the map and compass together (keeping them flat) so that the magnetic needle points to the top of the map.

The map is now orientated. You can now relate the features on the map to the ground.

Relating the map to the ground.

A handy pneumonic for relating features on the map to reality on the ground is DDCRAPS

D - Direction. The direction of a feature from your position to it will be the same on the ground.

D – Distance. Measure the distance from your position to the feature on the map. It should correspond on the ground (remember 'judging distance'!)

C – Conventional symbols. The more unusual or distinct the conventional sign, the more obvious it will be on the ground.

R – Relief. The hill features and contours may be the only recognisable feature in wild country or limited visibility.

A – Alignment. A linear feature (woodlines, streets, rivers, ridgelines, shorelines), will assist in confirming direction and identification. Taking a compass bearing along the feature will be useful confirmation.

P – Patterns. An obvious pattern on the map will be obvious on the ground.

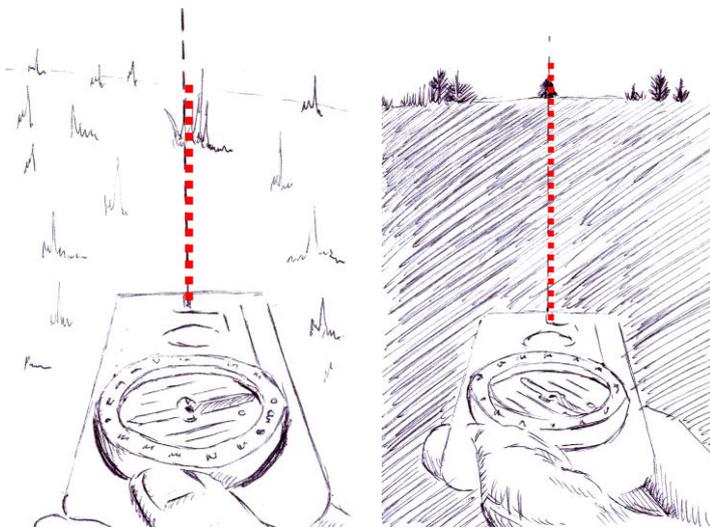
P – Proximity. The proximity of features to each other will help to identify it on the map.

S – Shape. The shape of a feature will help to identify it on the map.

All of the above can also be used 'vice versa' for relating ground to the map.

Understanding how to relate the map to the ground is an important skill. It will help you orientate by allowing you to 'confirm or deny' you are where you think you are using three or more separate features when you get to the waypoints on your route.

WALKING ON A COMPASS BEARING



It is possible to walk on a bearing by looking at the compass and zigzagging to conform to the needle, but inaccuracies will inevitably develop. The best way to walk on a compass bearing is to pick a distinct feature or object (e.g. an obvious

rock, or a prominent clump of grass) approximately 30m ahead along the bearing. Head to it and, as you approach it, pick another feature another 30m on the same line and so on. This technique can also be used at night, although alignment features may have to be closer. Prominent objects on the horizon can be particularly useful for maintaining a bearing.

Pacing should always be used when following a compass bearing. The further you go on a bearing, the greater any error or inaccuracy in your bearing will get. Keep the distances between known features short (ideally no more than 300m).

Human instinct naturally tends to curve away to left or right in low visibility. This means that, when walking on a compass bearing, it is easy to convince yourself that you are veering off course. When traversing a slope, there is a tendency to drift downhill. **Fight the instinct; stick to the bearing.**

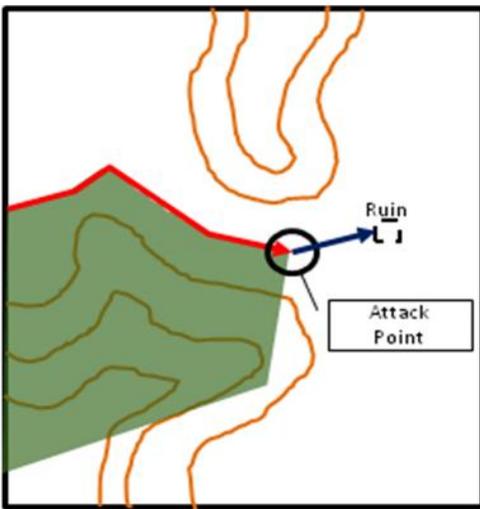
PACING

You **MUST** know by heart how many double paces you take to cover 100m. Ideally, you would have an accurate idea of how many paces you take for 100m uphill, downhill and through rough ground but this is probably unrealistic. When pacing over difficult terrain or a slope, you may simply need to judge how many more or less paces you will take.

It is useful to have some method of checking off every 100m (small stones, up to 8 plastic draw-cord toggles on paracord attached to the webbing, etc).

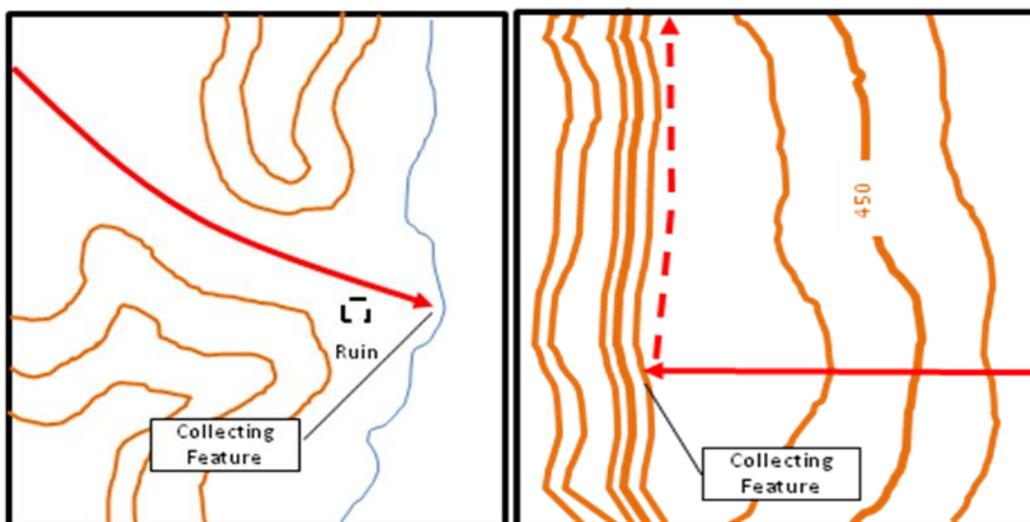
NAVIGATIONAL TECHNIQUES

Attack Points



This technique is used to help you 'home in' on a small feature that might be easily missed if approaching on a bearing over a longer distance. An attack point is a more prominent feature (e.g. a big lake, an obvious saddle, the corner of a wood) that is close to your ultimate destination. By heading to the prominent feature first, you can then reduce the margin for error considerably by reducing the distance.

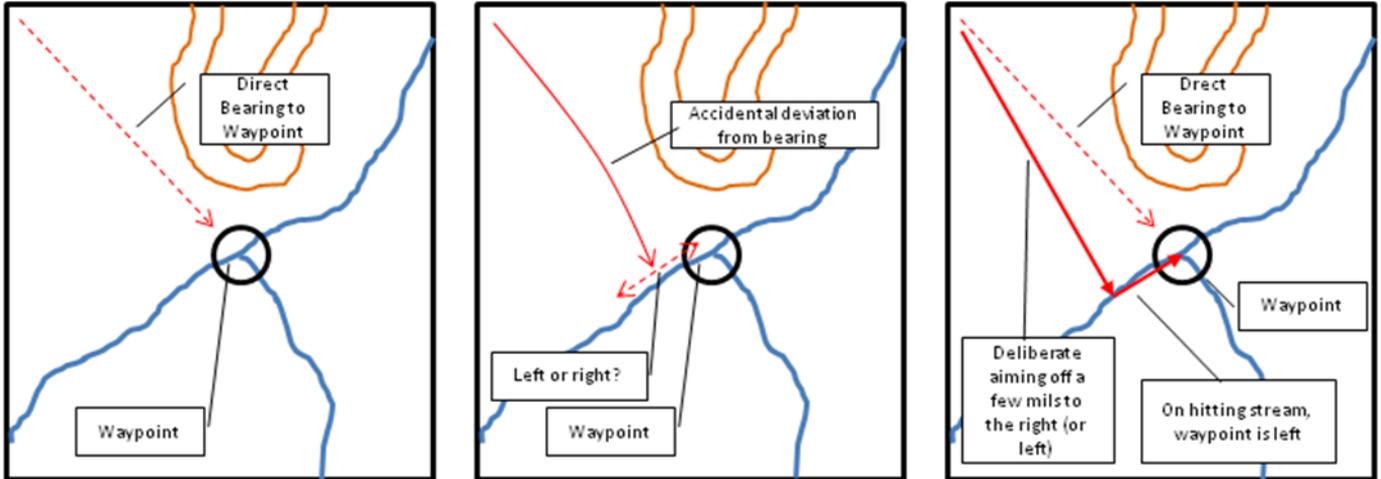
Collecting Feature



A collecting feature is a large, obvious, often linear feature a short distance behind your intended destination which acts as a 'safety net': if you hit the collecting feature, you know immediately that you have overshot. A

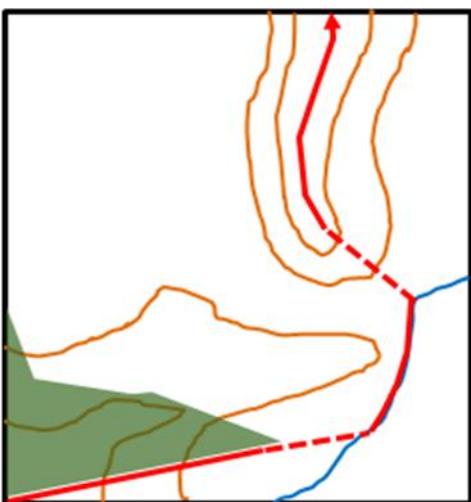
collecting feature could be a change in the slope angle, a stream or an obvious track. You may decide to head deliberately to the collecting feature beyond your destination and then use an attack point (e.g. a prominent bend close to your destination) on the collecting feature.

Aiming Off



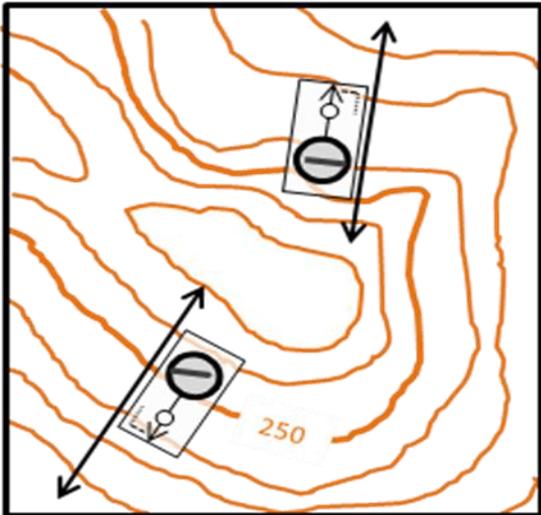
If you are heading on a compass bearing to a prominent point along a linear feature (e.g. a stream junction), the chances are, unless you are extremely accurate, you will not arrive at that exact point when you hit the stream. In low visibility, you may find it difficult to know which way to turn along the linear feature. By aiming off you deliberately introduce a slight error of several mils to the left or right of your destination into your compass bearing before setting off. When you hit the linear feature, you will then know which way you have to turn (and approximately how far) along the linear feature in order to hit the chosen point.

Hand Railing



Hand railing is a technique by which you follow an obvious linear feature (a stream, a major slope change such as a steep drop or a ridge line) to lead you towards your target. As you approach your target, you may need to use other navigational techniques to 'home in' on it. Navigation is often the linking together of a series of handrails together to form a route.

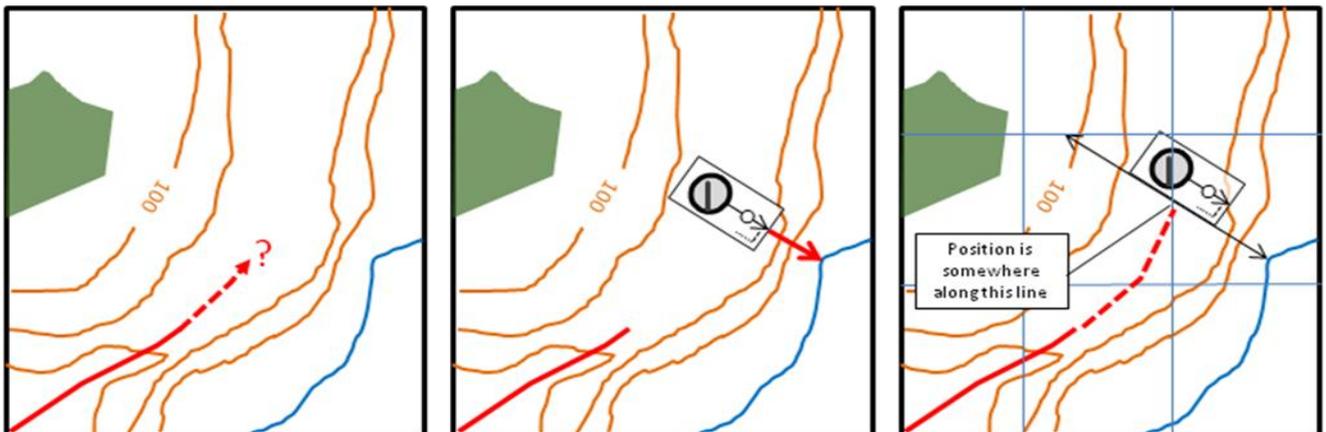
Aspect of Slope



Aspect of slope is an often underestimated saviour and may be all you have when disorientated or checking position in low visibility. It works on the understanding that a slope will descend or rise in a particular direction, and that the line of descent/ascent will be at right angles to the line of the contours on the map. Try to judge the direction in which the slope is falling and then measure a compass bearing along the fall line. Now place the compass on the map in the approximate area where you

think you are and move it until the edge of the compass bisects the contour lines at right angles. Accuracy will be key. You will be somewhere along that line and this alone may be enough to allow you to come up with a plan to get to a known feature.

Back Bearings



You may have been taught how to triangulate your position using three separate back bearings from known features to create a 'cocked hat'. In fact, this is not a particularly useful land navigational technique, particularly in low visibility. However, the ability to take a quick back bearing, based on a fleeting glimpse of a single definite feature may help you verify your location, particularly if you are moving along a linear feature such as a ridgeline or valley.

CONTOURS

Contours are key to navigation, but it takes time to learn how to visualise what the shape of the contours on the map actually look like on the ground. Take time to analyse contours. Keep things simple at first – direction of slope, steepness of slope, re-entrants, spur lines. Try to visualise what is happening to the ground between contours. On a 1:50,000 scale map, even the slightest kink in the contour line will be very prominent on the ground.

TACTICAL NAVIGATION

Hand-railing is the simplest and easiest of techniques, but unfortunately, may be the least appropriate to military navigation as the enemy may predict your route and ambush you. Obvious linear features should be avoided; linear contour features are less obvious, but avoid being silhouetted.

Reading a map can be awkward when light discipline is important. Most navigational errors in tactical situations can be ascribed to hasty map reading under poor light. As errors accumulate, the map will be consulted more often and light discipline will deteriorate. When checking the map, the navigator should be willing to go to ground and pull a light proof cover over his head (other members of the team can assist) in order to read the map properly or to take a new bearing. He should ensure that, on starting the next leg, he knows exactly what to expect along the route so that he does not need to check the map until he reaches the next waypoint.

A red filter torch will filter out all contour lines; a green filter all wood features; a blue all water features. Pinpoint white light is best, but one eye must be kept shut to preserve night vision.

PLANNING A ROUTE

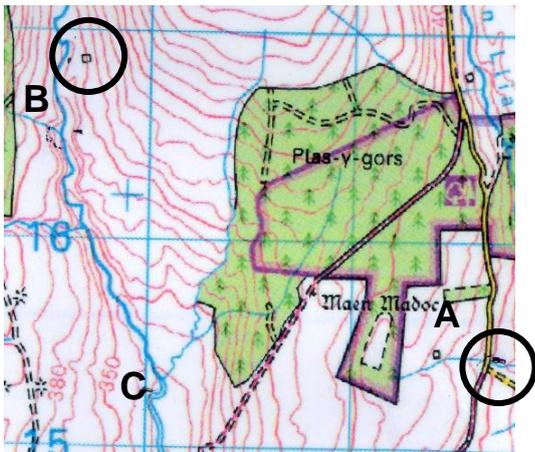
A route should be planned by moving between features (waypoints) that are prominent enough to confirm a position. These waypoints may also be used as tactical RVs.

The navigator may use other features in between waypoints; these are 'tick off' features that are used to confirm that the navigator is still on the correct route.

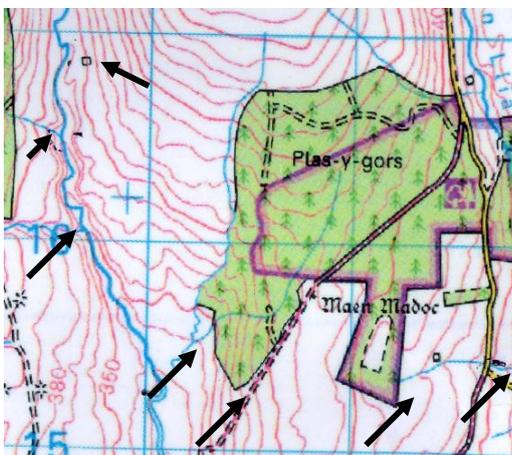
Navigation between waypoints, and from 'tick off' feature to 'tick off' feature will normally use a variety of the techniques described above. The shorter the distance between features, the less margin there is for error.

Unless a route card can be read at night it will be wasted effort. Keep detail to a minimum and only what is necessary (e.g. at most the key compass

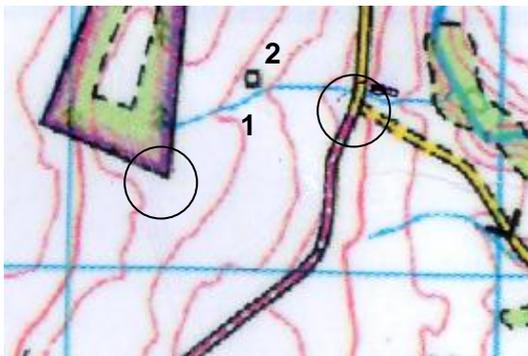
bearings that will be needed, distances and the associated 'tick off features'). Time is probably better spent identifying the key waypoints and familiarising yourself with the routes in between.



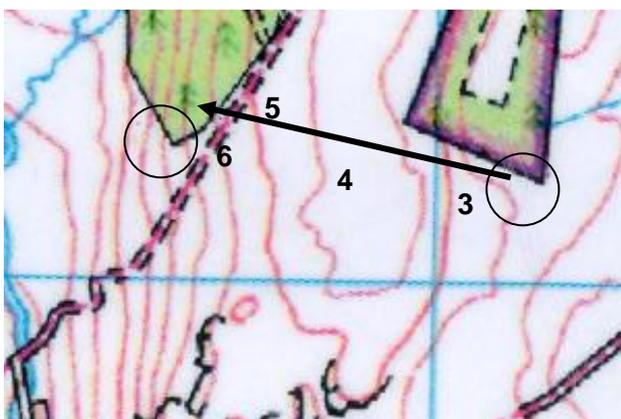
In this example, a patrol needs to get from a Drop of Point (A) to an RV (B). The J2 picture suggests that the enemy is patrolling along the lower reaches of the river 'C' and that he is aggressive in ambushing patrols using obvious linear features, particularly tracks and woodlines.



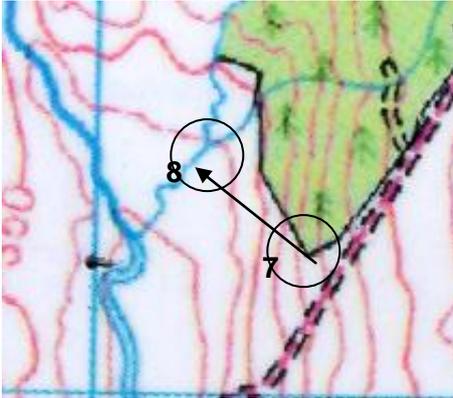
The patrol navigator now selects the waypoints he needs along the route. He selects features that are recognisable enough for him to be reasonably sure of his position. In doing so, he tries to keep the gaps between the waypoints short.



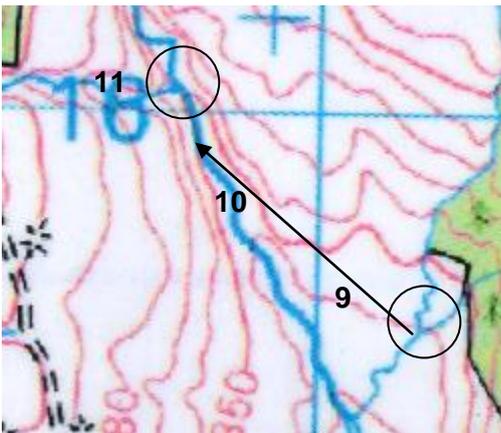
Leg One. The navigator decides to use the stream as a **hand-rail**. He takes a rough bearing to confirm that he is indeed heading east. He intends to hit the wood (a collecting feature) after 450m and then turn left (south) for 100m until he reaches the wood corner. He has two key **tick off features**: the stream enters a small rand increasingly steep re-entrant after 300m (1). There is a ruined building north of the stream after 200m (2).



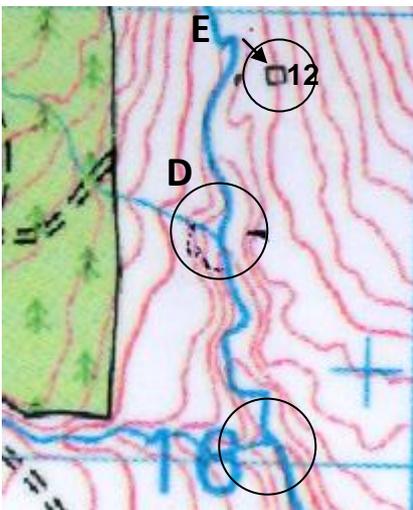
Leg Two. The navigator decides to head on a bearing rather than risk hand-railing the woodline. He deliberately '**aims off**' the corner of the wood slightly to the right so that the woodline will also act as a **collecting feature**. He then intends to turn left for 150m along the woodline. He has four key '**tick off features**': he knows that he should be heading uphill with a spur to his left at first (3); after 400m he should start to descend gently (4); he will hit a track after 650m (5); when he turns left on hitting the woodline, he will descend fairly steeply (6).



Leg Three. The navigator again decides to take a bearing, rather than risk the woodline. Again he **aims off**, this time to the right. The stream will act as a **collecting feature** and he will follow it north-east for about 100m (if he goes more than 200m without hitting the junction, he will stop and re-orientate). **'Tick off Features'**: the ground descends sharply for the first 150m(7); when he turns right on hitting the stream, he will be heading slightly uphill(8).



Leg Four. This is an unavoidably long leg. The navigator chooses to avoid hand-railing the stream line for as long as possible, and takes a risky bearing that aims off 200m south of the stream junction. At this distance, inaccuracies as he walks on the bearing are inevitable, but the stream acts as a **collecting feature**. The key **'tick off features'** are: the ground rises gently for the first 350m (9); after 400m the ground drops sharply into a deep re-entrant which has a large stream in it (it will be noisy) (10); at the stream junction, another re-entrant leads away to the west (11).



Legs Five and Six. The navigator decides to hand-rail the stream keeping on the high ground to the east for the full 400m. He knows that there is a prominent spur that he will cut across after 150m. This spur also causes a distinct kink in the stream. On arrival at the stream Junction (D), he decides to continue **hand-railing** the stream as far as the prominent kink 400m to the north (E). He will use this as an **attack point** from which to head on a bearing of 2360 mils for 100m to get to the ruin. If he overshoots, the steep ground to the east of the ruin will act as a **collecting feature** and indicate that he has overshoot (12).

IF LOST

You will never get catastrophically lost before you pass through a stage of being 'disorientated': not knowing exactly where you are. It may be that a 'tick off' feature hasn't appeared where it should, or, on arrival at what you think is a waypoint, the evidence doesn't inspire a 'warm and fuzzy' feeling.

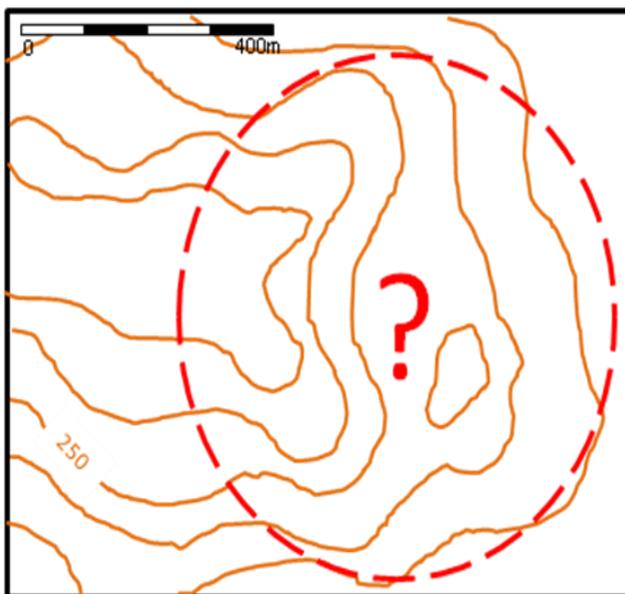
As soon as you are uncertain, **STOP** and take time to think. Everything you do from this point on must be in accordance with a careful plan; panicking

and setting off into the darkness in the blind hope that 'something will appear' will lead to becoming catastrophically lost.

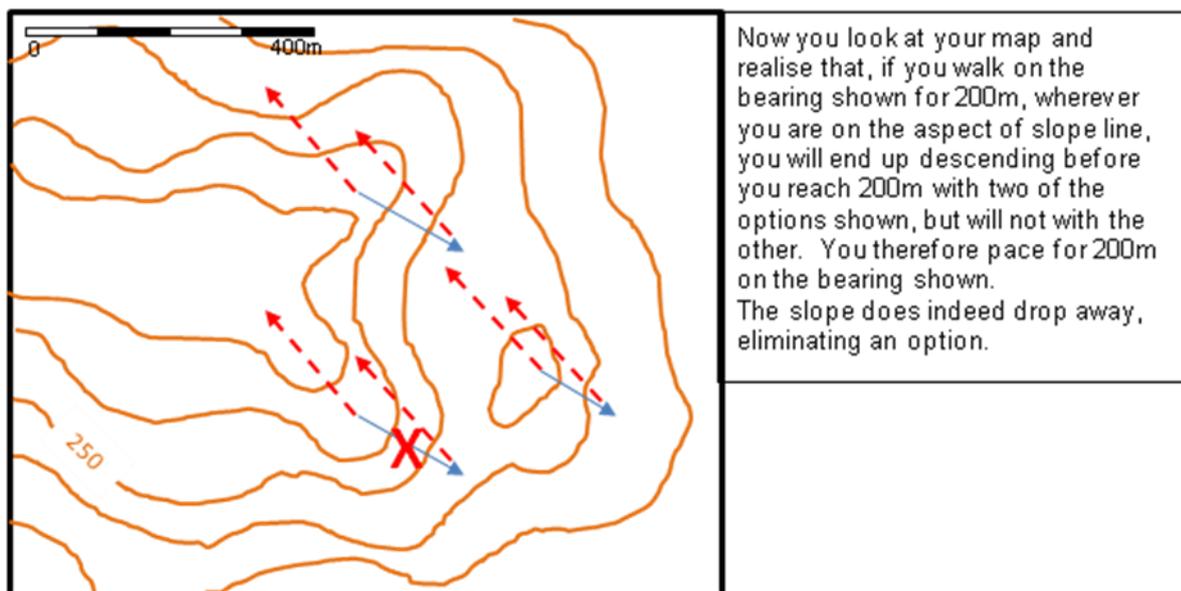
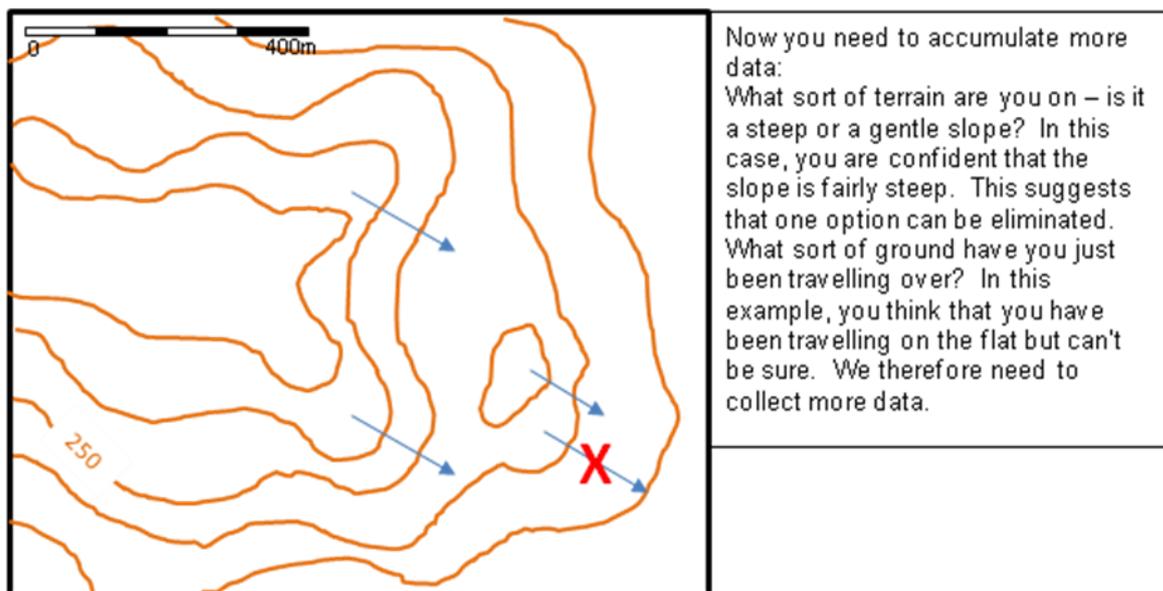
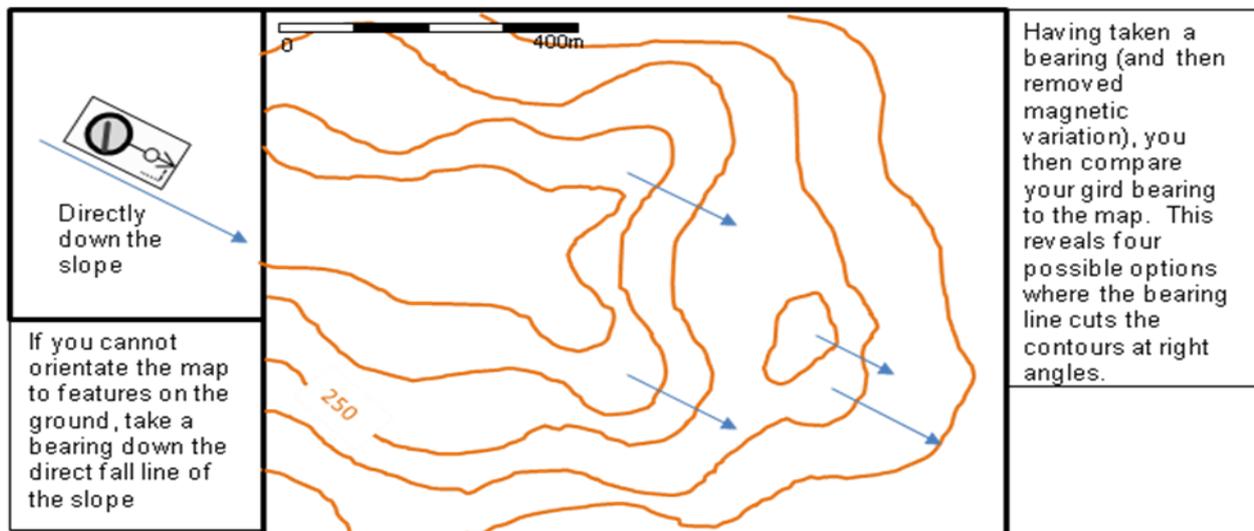
- Check the evidence. What can you see around you? How far away is it, and in what direction? If there is a linear feature nearby, what direction does it follow? Check these against your map.
- Where were you last sure of where you were?
- What terrain were you walking on? Was it flat, downhill, uphill or in a valley?
- What direction were you walking in? Did you take a bearing?
- How far did you walk from the last known location?

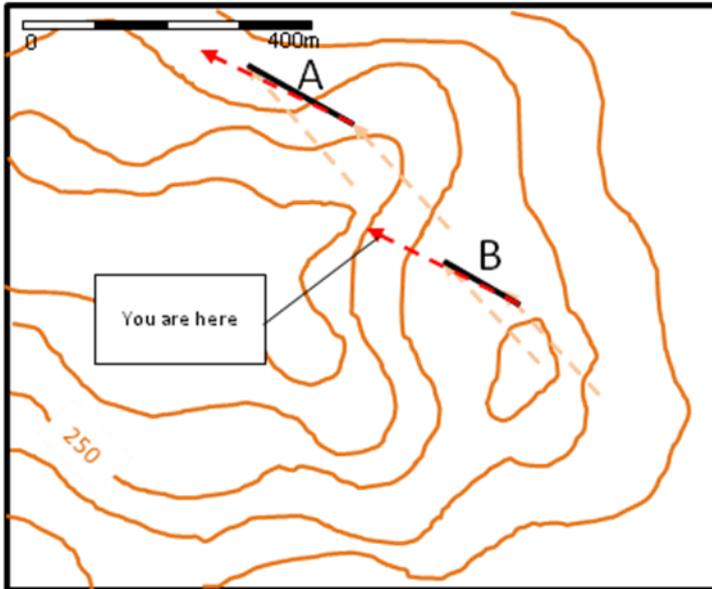
Use aspect of slope; this is a crucial skill and will give you a position line from which you can start to gather more evidence. Be careful though – it is very easy to make the evidence fit what your mind wants it to fit.

Re-orientating – An Example



In this scenario, you have found yourself disorientated on a hillslope. As soon as you are uncertain of where you are stop and think.





If you have taken your bearings accurately, you should be somewhere along either of the black lines shown. If you now pace out a further 200m, either the ground will rise sharply (B) within 100m, or it will not (A). You should check this. In this case the ground does indeed rise sharply so you are at B. You may wish to double check by pacing a further 100m in which case, you should cut across the top of the spur and start to descend

If you cannot resist taking a look further on to see if the feature appears, do so by taking a bearing and measuring the distance. Set a limit to how far you go and make sure you can return to where you were when you first felt disorientated.

NAVIGATION TRAINING

There is no substitute for getting out and practicing on an area of common or wasteland close to home. Take time to practise in low visibility, but take the necessary safety precautions if you are heading for remote terrain. Ensure that you take appropriate foul weather equipment and inform someone where you are going and when you will return. Training is optimised when you are on your own, away from distractions, but weigh up the risk before you disappear on your own. These training suggestions are a guide for both students and training staff.

Subject	Exercise	Remarks
Check Pacing	Go to a known 100m length and measure your double pace over 100m	Note that football pitches can be between 100-110m and are not accurate. Either ask your PT Wing to measure out 100m or find a local athletics track.
Route Planning	Set yourself a route over several km using 1:50000 and 1:25000 scale mapping. Identify the waypoints and talk yourself through the ground and tick off features along the route.	
Walking on a Compass Bearing	Find a flat open space, preferably open country, though a sports pitch will do. Walk on a bearing for 200m, then stop and turn your compass through 1600mils. Head on that bearing for	You will need to force yourself to walk on the bearing rather than head for the point.

	<p>200m. Repeat this until you have completed a square.</p> <p>This exercise should be repeated in darkness.</p>	<p>If you haven't ended up back where you started from, try to work out why not. Were you accurate? Did instinct take over on one of the legs and you made an adjustment?</p>
Contours 1	<p>Find an area of the map with plenty of contours. With a fine pen or pencil, try to mark out the ridgelines and spur lines to get a feel for the shape of the ground. Make sure that you look at all the bulges in the contour lines, even if slight.</p>	<p>Take time to think about what is happening to the ground in between the contour lines.</p>
Navigation	<p>Find a local area that offers easy access. Plan a route over 3km on unfamiliar terrain between obvious waypoints. Try to use as many techniques covered in this booklet. Go and practice in daylight. Repeat the process over different terrain at night.</p>	<p>You can increase the complexity by banning yourself from handrailing any feature other than contours</p>
Contours 2	<p>Find an area of local accessible open country with plenty of contours. On a 1:50,000 scale map take a piece of acetate and trace out the contour lines only (include the heights where marked) in one area (3km² is easily enough) using a fine permanent marker pen. Photocopy the acetate. Now plan and follow a route using the contour features alone. If you can do this in darkness, you are pretty much there.</p>	<p>Make sure that you take the actual map with you as well!</p>
Reorientation	<p>When practicing navigation in low visibility, stop concentrating and continue for 2-3 minutes. Now re-orientate.</p>	<p>Have a clear escape plan (i.e. head south 1km until you hit the road) in case you get lost.</p>

You will inevitably make mistakes when you train. Do not be disheartened; learn from them.