NO EASY WAY OUT

CREVASSE RESCUE

It is glaciation, cloaking the mountains in snow and ice, splintering rocks into fantastic shapes through the freezing and thawing of water in cracks, that makes alpine mountains so spectacular, exciting and potentially hazardous.

Rob Collister from Plas y Brenin takes a closer look at the infamous and uniquely alpine danger – crevasses, and the legendary art of crevasse rescue.

Glaciers

Glaciers are the bodies of permanent snow, hardened by time and pressure into ice, that flow out of the mountains. They are fed by the heavy snowfalls of winter then melt in the warm temperatures of summer. When the melt rate at the snout (front) of a glacier is greater than the rate of advance caused by gravity, it is said to be retreating. For the last 100 years the world's glaciers have been retreating, growing steadily smaller and becoming covered with rock that falls onto the ice from the surrounding mountains to form moraine. A moraine-covered glacier is, in effect the rubbish tip of the mountains, and about as much fun to walk on, but there are far more sinister hazards to be found lurking in this environment.

Glacier ice is a plastic substance, soft enough to flow downhill, but stiff enough to crack when stressed. Such stress occurs on the outside of a bend, whenever the bed surface steepens, or at the sides where friction causes the ice to flow slower than in the centre. In all these cases, a glacier will split open to form crevasses. These can be anything from a centimetre to fifty metres wide. Larger crevasses are invariably scary to look at, and seem to try and suck you into their dark blue depths, but in reality it's the smaller ones of one to two metres across that are the nastiest, being less obvious but quite wide enough to fall into. And although glaciologists tell us that crevasses rarely exceed 50 metres depth due to pressure constraints, this is scant consolation for the hapless climber.

(TOP) Crevasse rescue practice on a Jonathan Conville course. (RIGHT) Now what? Wait patiently and hope your friends have mastered the arts described on pages 16-17! Credits: Payne

Roped up for glacier travel, note the tied off coils. Credit: Payne

Look out — there's a crevasse about!

In summer, the lower parts of most glaciers, when not covered with moraine, become bare of snow, revealing ice, a so-called "dry glacier". Here crevasses are without malice and provide useful places to practise ice climbing and rescue techniques. But higher up when masked by snow (a "wet" glacier) they become a very different proposition. Identifying possible crevasses under snow is a skill only mastered by experience, often only a faint dimpling of the surface to the right or left may be discernible, perhaps leading to an open hole some way off, and after fresh snow even such subtle clues are hidden and extreme care is required.

Glaciers are at their safest in spring when there is still a lot of winter snow about, and freeze-thaw is strengthening the bridges. In summer, crevasses are relatively safe early in the morning when the snow is (or should be!) frozen hard, but by the afternoon it will have softened and bridges will be in a precarious state. As the season goes on, crevasses become increasingly open. By the end of August, glaciers that were straightforward ski runs in April can be all but impassable.

Rope Up!

As a rule always rope up on a wet glacier, tracks in the snow or other unroped parties are no guarantee that a glacier is safe and there have been fatalities even on well-used hut walks like the Argentière glacier. There is a lot of misconception about roping together, but the key to safe glacier travel is to have little or no slack in the rope. Bodyweight combined with the friction of the rope biting into the crevasse lip are normally sufficient to hold a fall, but only if there is no slack, coils in the hand just increase the length of a fall and the difficulty of stopping it.

There is definitely safety in numbers when it comes to glacier travel. The more people there are on a rope, the less chance there is of the whole party disappearing forever down the same hole, nonetheless, it is still wise to keep well apart. 10m between each climber is ideal for a rope of three or more. However the more usual, and more hazardous, situation is a rope of two, in which case it is worth having 15m of rope out. At the same time, each climber needs to have a similar length of rope in coils, tied off, for use in a rescue. Do remember that whatever the size of the party, do keep well spaced out even when stopping for a break. There have been a number of cases when the combined weight of two climbers coming together for a breather proved too much for a crevasse bridge which has collapsed, killing them both.

Remember, too, that the inside of a crevasse is a bitterly cold place, however hot it may be on the surface, and that snow is extremely abrasive to skin. Always wear gloves and at least a long sleeved shirt when travelling on glaciers.

Weaving your way

As you delicately progress across the glacier be alert for all suspicious signs such as dimples, cracks, and hollows. If you are confronted by a suspicious-looking hollow in the snow, probe it with your axe or a ski-stick. If the axe goes straight through, or the crevasse bridge collapses into the depths, try again elsewhere!

It is not unusual to have to weave back and forth across a glacier, crossing or jumping each individual crack at its narrowest or safest point. Late in the season, the only bridges remaining may be wildly improbable cantilevers of dripping ice. Often, they are stronger than they look, but take no chances. Arrange a belay or stake, take a strong sitting stance, then cross on all fours to spread the weight as much as possible.

Break Through

Sooner or later, however, you will go through a crevasse whose existence you never suspected. Whether you plummet to the bottom, find yourself dangling on the end of the rope contemplating a bright circle of daylight somewhere above, or merely feel your legs kicking in space while icicles tinkle far below, will depend entirely on your partner.

If someone on your rope does suddenly take the plunge then falling backwards will always be more effective than trying to thrust an axe into the snow or attempting a boot-axe belay. It all happens very quickly and there are no substitutes for alertness, quick reactions and a tight rope. Admittedly, that is easier said than done at the end of a long tiring day, but ironically that is precisely when the bridges will be at their weakest.

Dilemma Time

Should the worst happen, dangling on the end of a rope is considerably more comfortable with a chest harness or with the high attachment point provided by taking coils over one shoulder, tying them off with a full hitch and clipping the bight of rope remaining into the belay loop of a sit-harness. This system is most effective if the coils are kept as short as possible without being uncomfortable and the bight is also kept short so that the impact of a fall comes first onto the sit harness; the function of the coils is only to prevent the upper body falling back with the possibility, especially with a heavy sack, of inverting. Unfortunately, holding a fall into a crevasse is much easier with a low attachment point. A sudden pull to a chest attachment is likely to pluck one head first towards, or even into, the crevasse.

One solution to this dilemma is for the person in front, being the most at risk, to have an improvised chest harness as described, while anyone else on the rope has a low attachment point. Another possibility is for everyone to have a chest attachment but to also have a short prusik loop on the rope at arm's reach in front of them; this acts as a hand loop to pull on, giving an extra split-second in which to fall backwards and dig the heels in.

Turn over to find out how to get out of a crevasse.

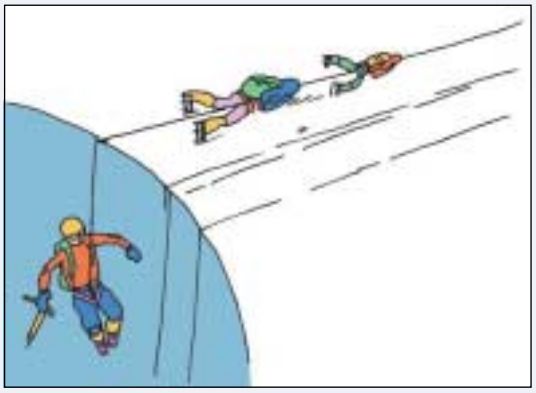
NO EASY WAY OUT

Now get out of this!

Make no mistake, rescuing someone from a crevasse, or extricating yourself is NOT easy. You are only likely to be successful if you are totally familiar with the techniques involved and have practised them in a fairly realistic situation e.g. on snow as opposed to a warm, dry climbing wall. On the other hand, be wary of practising in situations that are too realistic – there is a lot that can go wrong! The ideal training venue is a wind scoop or a natural hollow on a glacier that has a corniced lip but is visible and easily accessed from the other side. Many outdoor centres offer alpine training courses including crevasse rescue, and if in any doubt as to your own ability, consider a few hours of expert training.

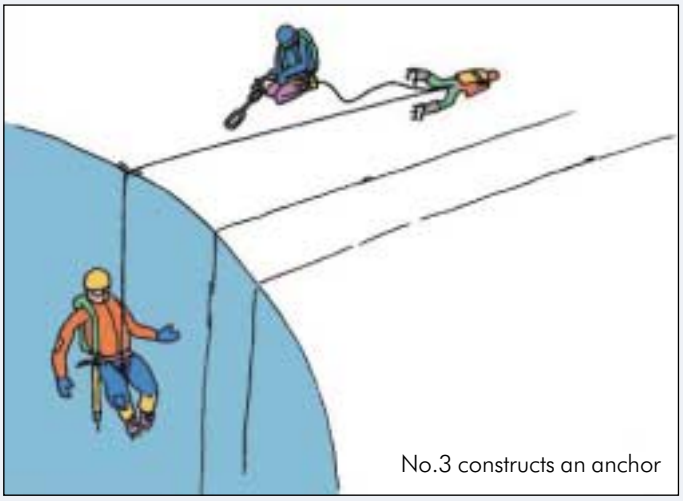
Scenario 1

The leader of a party of three has fallen through a bridge and the combination of some initial slack and subsequent stretch in the rope has left him swinging in space ten feet down. The rope has cut deeply into the snow and the other two climbers are lying on their sides with the rope tight to their harnesses (diag. below).

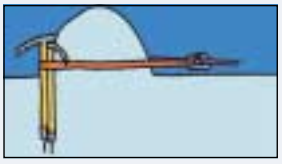


Stage 1

The first step is for No 3 to construct an anchor. Assuming that No 2 can take the weight alone, No 3 moves forward to do this just behind No 2. Doing it further back could leave them short of rope, unless they are carrying a second one.



No.3 constructs an anchor



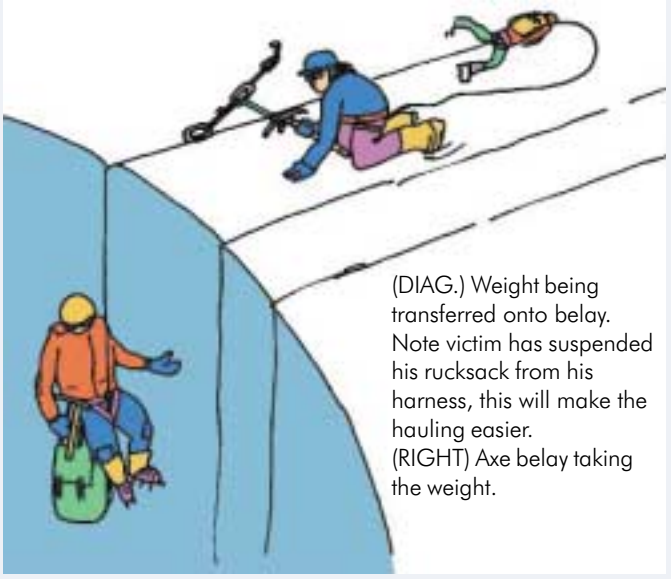
With a thin snow cover, the best anchor is likely to be provided by ice-screws, ideally at least two of them, 18 inches apart, and linked with a sling so that they are equally loaded. This can be achieved simply by tying an overhand knot near one end of the doubled sling to create two separate loops. The short loop is clipped into the nearest ice-screw, the longer loop into the furthest; adjust the position of the overhand knot so that a karabiner clipped into the bottom of each loop, at the knot, will load both screws simultaneously.

With a thicker snow cover, the belay of choice will usually be a horizontally buried ice-axe, preferably strengthened with an axe or hammer placed vertically in front of it (a T-axe belay); then clove-hitch a long sling to the mid-point of the shaft. If there is plenty of space and plenty of rope, a snow bollard is a good alternative, especially if a couple of axes or ski-sticks are placed at the back to prevent the cheese-wire effect.

(LEFT) Bollard Belay, T-axe belay, and equalised ice screws

Stage 2

Next, transfer the weight of the fallen climber from No 2 to the anchor. This can be achieved by putting a prusik on the live rope (a French prusik is best as it can be released under load if need be), then linking it to the anchor with slings. No 2 eases himself cautiously forward until all the weight is being taken by the prusik. The rope from 2 to 3 should then be clove-hitched into the anchor, just in case, and slack taken in as No 2 unties.



(DIAG.) Weight being transferred onto belay. Note victim has suspended his rucksack from his harness, this will make the hauling easier.
(RIGHT) Axe belay taking the weight.

Stage 3

Now the lip can be prepared, and the other end of the rope must be dropped to the victim. More often than not, the live rope will have dug in so deeply that it will be impossible to use. Loose snow must be hacked away from the lip (preferably a few feet to one side of our friend down below) and ice axes, ski sticks or a rucksack placed at the edge to prevent the new rope cutting in. If there seems to be a danger of losing them, they may need to be attached to the old rope or to a vertical axe belay with a prusik. All this can be done by, say, No 2, protecting himself with a long prusik to the live rope. This stage is very important if the hoist is to be successful, but because alpinists usually practise on rock or on a dry area of glacier, it tends to be underestimated, if not overlooked altogether.

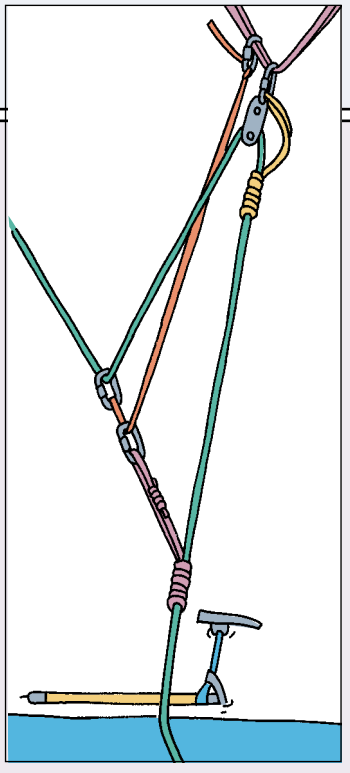
The Z pulley system

Stage 4

While No 2 is establishing contact and preparing the lip, No 3 can be setting up a pulley system. There are many possible methods but the traditional Z pulley is tried and tested and as effective as any. The new live rope to the victim passes through a karabiner on the anchor, and is brought back towards the crevasse where a French prusik is attached to the live rope as close to the edge as is safe. What is now the haul rope is clipped into the prusik and brought back towards the anchor thus completing a Z shape in the rope, which gives a mechanical advantage of 3 to 1. This means that to lift the victim one foot, three feet of rope will have to be hauled in, so that the prusik on the live rope will almost certainly have reached the anchor before the climber has been extricated. To hold his weight while the prusik is slid back down the rope towards the crevasse, another French prusik is put on the live rope and clipped to the anchor with a separate krab. This acts as a clutch, allowing the rope to run freely while it is being hauled in, but taking the strain when the haul rope is released. Devices like the Ropeman and the Tiblock can be used as alternatives to prusik loops, and there are several different types of prusik knot. It is worth experimenting to discover the pros and cons of each. A small pulley on the hoisting prusik is invaluable in reducing friction and weighs next to nothing.

Stage 5

Assuming there are no problems getting the new end of rope down to the victim, No's 2 and 3 can now start hauling. With only two on the surface it will be hard work! The original rope, probably still dug deep into the snow, is best left slack as the victim is hoisted, lest it catch at the lip. (Obviously, if the snow cover is thin and the rope has not cut in very far, it may be possible to use the original rope to haul, which will speed up the whole rescue considerably.) No 3, still attached to the original rope with a prusik, acts as a link-person to the victim throughout and is on hand to help as he or she crawls thankfully over the lip.



Scenario 2

Now imagine your partner has plunged down a crevasse and you are alone on the surface with the rope taut to your waist. You are unlikely to hear your partner (no matter how loudly he or she shouts). If your partner is familiar with the techniques for prusiking you might just be able to lie there and let them get on with it. However, your partner may not be in a position to get themselves out. So, you will have to construct an anchor and transfer the load while still holding their weight which is not easy. Once that is accomplished you should try and make contact with your partner to assess the situation (you can belay yourself towards the edge using the spare end of the rope). To hoist them out you will probably find an ordinary Z pulley insufficient. Alternatives include getting your partner to help in an assisted hoist, or increasing the mechanical advantage of the Z pulley. You can double the mechanical advantage of the Z pulley by adding an extra strand in the hauling system by using the spare end of the rope, or better still by using a length of static cord or tape (a 6 metre length is ideal and doubles up as abseiling 'tat'). One way of doing this is to tie one end of the extra strand into the anchor and passing the other end through the hauling prussic and linking it with a karabiner to the hauling strand. Even by doubling the Z pulley you will still need to use a very effective hauling technique by wrapping the hauling rope over your shoulder and using the strength of your legs to pull. It goes without saying that you will need adequate equipment that is easily accessible if and when someone falls into a crevasse.

Food for thought

Then there are all those nightmare scenarios that are worth pondering in an idle moment: unroped climber unconscious at the bottom of a deep crevasse; unroped climber wedged in a constriction; roped climber 20ft down and unable to help themselves. There are no easy solutions to any of them, but all will be more easily resolved if there is more than one person on the surface, and all can be avoided by being roped up and keeping slack to a minimum. As always, prevention is far better than cure. Good luck!