DANGERS: Safety and Techniques

Because they can date quickly we have included only a few articles relating to techniques. Safety has been regularly canvassed in newsletter articles (e.g. no. 56, 1972) and guideline documents prepared for several aspects of safety, so that ASF's safety record is outstanding on a world scale and it is over 40 years since the only fatality ever incurred on an ASF member society trip. While hypothermia is well recognised, especially in Tasmanian caves, we have included articles on hyp<u>*er*</u>*thermia, a significant problem in tropical caves including northern Australia..*

DIFFERENTIATING NYLON & TERYLENE

Simon Jolly

ASF Newsletter 91 (1981)

Most cavers are aware of the alleged danger of the concurrent use of lead acid batteries and nylon vertical gear, and similarly alkaline batteries and terylene gear. So, is that tape of yours nylon or terylene?

It is a simple process you might think, to test the effect of acids and alkalines on a small sample, but in practice this gives far from clear results. Concentrated mineral acids rapidly dissolve both nylon and terylene and weaker solutions often have no appreciable effect on either. On several terylene samples I have tested, prolonged boiling in a concentrated sodium hydroxide had no visible effect.

If one looks up the text books, it seems a definite test for terylene (polyester) is that it dissolves in boiling O-dichlorobenzine in less than six hours. Furthermore, hot formic acid will dissolve nylon (polyamide) but not terylene.

A far simpler test I have found is to immerse fibres of the tape to be tested in a saturated solution of potassium permanganate (Condy's Crystals). The solution must be super saturated, that is with crystals undissolved after vigorous mixing. In a day or so nylon fibres are considerably weakened and soon disintegrate completely. Terylene remains completely unaffected.

You can now go caving with that 'Montgomery ring of confidence', though I can't help thinking if this morbid fear of the vulnerability of our tapes is really justified.

HOW LONG WERE YOUR ROPES?

Alan Warild

ASF Newsletter 102 (1983)

For several years it has been known that synthetic ropes shrink with use. During the last 12 months I've been taking some comparative measurements to find out how much. While collecting ropes for the Muller '82 Expedition we made a point of marking lengths on all ropes, and quickly found that ropes brought in as 50m. lengths were characteristically only 43 to 46m. long when measured (8-14% shrinkage). Following on from this we found an almost new 100m. Bluewater III to be 93m. long (7% shrinkage).

Muller '82 took 5 x 200m. rolls (measured at 202 m to 204 m) of Beal Dynastat to New Guinea. When cut into quarters, and used a lot we ended up with 4 x 45m. ropes (ie total of 180m; 10% shrinkage)). Equally dramatic shrinkage occurred in my Bluewater 9mm. Bought as a 200 m roll in December, used in New Zealand for 4 weeks its total length by the end of January was 179m. (10% shrinkage). It appears that you can expect a 10% to 15% shrinkage during the first few uses and thereafter it begins to stabilise. So if you want a 50m. rope perhaps it would be a good idea to buy at least 55m..

A GUIDE TO CAVING ROPES

Alan Warild

ASF Newsletter 103 (1984)

A great deal has been said and a little written about caving ropes over the last year or so. To such a degree that several "experts" have got their sit-harnesses somewhat knotted as to what is safe/dangerous/spins/bounces/costs too much etc.

When buying a rope you either know what you want or ask advice. Unfortunately the most often volunteered advice comes from those people trying to sell you the rope. As no one shop sells all of the available brands of rope it is unlikely you'll get an objective story from anyone!

After reading and hearing a considerable amount of dubious information on caving rope I have put together some of my own tests and experience and combined this with work from other sources to give what I hope is a more complete picture.

By knowing something about what you want and why you want it, "beginner" rope buyers, can make a more informal choice and the experts may re-think about whether they are getting what they thought they were getting.

Diameter

In general terms, the thicker the rope the "safer" it is. Thicker ropes are easier to hold on abseil and when used as handlines. Ascenders usually climb better on thinner ropes. Most people seem to prefer an 11mm rope – probably for the feeling of security it gives, although, when badly rigged even the toughest rope can be dangerous. Virtually all of the rope characteristics to be discussed are controlled largely by the rope's diameter.

Breaking Strain

If you look only at ultimate tensile strength then almost any synthetic rope over 8mm diameter would be "strong" enough but unless you are lifting boulders with your prussik rope the load will never progressively increase until it reaches the rope's ultimate tensile strength.

The more important "strength" to consider is whether or not the rope can withstand a "shock" load. Climbing ropes must survive a series of falls in which an 80 kg load is dropped 5 metres and stopped (hopefully) by a 2.5 m length of rope. This is known as a "Fall Factor 2 Fall (80kg)" and while highly possible in climbing is relatively rare in SRT.

A fall factor 1 (fall=rope length) is the usual maximum (greater than Fall Factor 1 falls could occur if you are above the belay point when clipped to the rope as many people are, when preparing to abseil.) See Figure 1.

Static ropes, because of their lower stretch and consequent lower shock absorbing ability cannot perform as well as climbing ropes but they should survive at least one "Fall Factor 1 (80kg)" fall. This is especially important to those who still use sailing ropes such as Marlow and Downs. Recent tests in the UK have shown that even good 10mm Marlow never survives even one "Fall Factor 1 (80kg)" fall.

Most ropes are constructed such that the whole of the rope absorbs load progressively until it breaks. Ropes such as Viking Super Speleo and Beal Dynastat have a different construction and are designed to perform in a different manner. They both utilise a low stretch care which supports the load in normal use. If a severe fall should occur though, the low stretch core would be unable to survive the shock load and would break. The load would still then be supported by stretchier shock-absorbing sheaths. Although the Kevlar core of the Viking appears to be quite "strong" in relation to the total strength of the rope it has rather poor shock absorbing ability - hence the need for a stretching sheath.

The next time you prussik up to a main belay point consider how far you would fall should that belay fail. Compare it with the length of rope to your secondary belay. (Fortunately a lot of shock would be absorbed by your body, harness and pendular movements.) This gives the lie to those who consider that shock loads don't happen in caving

Elongation at Failure

Greater stretch indicates greater shock absorbance but otherwise a useless statistic unless you want to calculate whether you'll hit the bottom before or after the rope breaks.

Elongation in use

Stretch is highly variable even within the same type of rope. New ropes normally stretch less than older ones. Low stretch ropes are easier to prussik on, especially if using the Frog System against a wall. It is also easier to guesstimate the placement of protectors and to allow for stretch between belays.

Stretchy ropes absorb shock loads better and so place less strain on belay points and falling cavers. It is not hard to get used to prussiking on stretchy rope.

Rope stretch is roughly related to diameter so some compromises must be made. Few cavers are willing to drag around a 13mm rope just to ensure bounce-free abseils. At the other extreme I prefer to use the stretchier 9mm ropes and carry much less weight around.

Resistance to spin

With the advent of kernmantle ropes spin is a non-event unless you coil your ropes. Coiling can generate twists with each loop on or off the coil and can lead to some unpleasant side effects (helical chunders etc.).

Abrasion resistance

Abrasion resistance is an extremely difficult thing to measure and as yet consistent reproducible test results have not surfaced.

As a general rule the better wearing ropes have a harder more compact sheath and as a consequence are normally stiffer. As far as total destruction goes the thicker ropes last longer (more or less) but if you are only looking at "biting" a hole in the sheath this may not be the case.

Thicker, tougher ropes are more suited to those who don't want to spend the time and effort involved in rigging ropes free of the rock. No matter how careful you are about rigging your rope it will still wear out from the effects of nasty dirty cavers sliding down it.

Again a compromise must be found because tougher ropes also tend to be heavier, stiffer and more expensive while lighter, softer, cheaper ropes don't normally wear as well.

Handling and Knotability

Ropes normally start out nice and soft and head toward "wire" rope. A rope which is stiff when new has a considerable head-start on one which is initially soft. Stiff rope has only one advantage – it tends to run through ascenders better.

The main disadvantage of stiff rope is that you simply can't get as much of it in your pack as you can with similar soft ropes. If you leave the rope outside your pack it will only get even stiffer and wear out faster. Stiff rope can also be rather nasty to abseil on, especially with non-variable abseil devices.

Tying knots in stiff rope becomes a real test of strength and often requires a lot of rope. Thicker ropes tend to be harder to bend so stiffness is more of a problem with them. By washing and fabric softening your rope between uses its downhill slide to "wire" rope will be slowed markedly.

Weight

Weight is a crucial factor if you are rigging a deep cave with only a few people. If the cave is high up a mountain then weight is even more important.

The new weight is a reasonable guide but ropes only ever seem to gain weight. It has been said that nylon ropes gain 10% - 15% extra weight by absorbing water during their first wetting and then retain that water. This is not so. If you buy a new rope and measure and weigh it, then wash and dry it, you will find that it is about 5% shorter and weighs exactly the same. But if you calculate its new weight per metre it will now be 5% heavier.

Some ropes shrink up to 15% with only a few weeks of heavy use so you can expect it to be up to 15% heavier per metre with age. A rope's weight when wet (i.e. completely saturated like it is in your rope pack) seems to be consistently 35% - 45% above its dry weight, the values for old ropes being more relevant. Some ropes dry out much faster than others which may be important if your rope also goes canyoning.

I'll bet you thought your old Marlow was heavy when wet, I found that it had a 64% weight increase when saturated and lost no measurable weight hanging in the sun for 15 minutes!

Price

Although price is an important consideration it is usually better to buy what you want if one particular rope is in your opinion "outstanding". Remember that a thinner, cheaper rope could cost you more if you wear it out faster. Most shops will give you some discount if you buy a full 200m roll.

Part Two of this article, entitled "Which Rope Is The Best", will be printed in the next issue.

PETZL AUTO-STOP DESCENDER: MARK's OPINION

Mark Wilson

ASF Newsletter 103 (1984)

With a NZ trip coming and faced with the thought of carrying my New Guinea-proof 12" water pipe bar rack across, but mainly up, mountains I decided something lighter was the go.

Enter TSA catalogue, and about three months later, after French translations, bank drafts, customs and Australia Post officials' "Sorry, but we seem to have lost half your package, but pay the duty any way" I ripped open the package to see the auto-stop in the flesh – bright blue body and sexy red handle. So with just one quick trip down Drum (B13, Bungonia NSW), to try it out it's off to New Zealand.

To cut all the drivel that seems to have filled the page above, the big question is "Is it any good?" The answer "BRILLIANT".

The auto-stop works well on ropes up to 12mm, it definitely won't work on NZ-type-rope 10/80H (suitable only for mooring ferries). Although I didn't take any totally-out-of-control plunges down shafts to try out the auto-stop, it did seem to work well, but it did creep a little when there was no bottom weight (this was on brand new Blue Water 9mm at the bottom of the pitch).

I found the auto-stop great for rigging, just slide down the rope, release the handle to stop, rig away to your heart's content, then grab the handle and you're away (watch out you don't bash the handle or you may go when you want to stay, quite exciting . . . beginner's mistake!)

The Petzl also has the advantage of being very quick on and off the rope, unlike the old PNG "knee breaker". The Petzl in comparison is also much shorter (about 8") and lighter (just over 300g), and rated by the manufacturer at 1500kg. As for the big pits, it was great on Harwood's (176m) using Blue Water 9mm although it did get a little warm (if you take it slowly you won't need your water pistol!).

The Petzl is slightly faster than other devices I have used but it is only a matter of improving your technique and using your body occasionally to generate more friction.

Although the auto-stop won't give you the same super frictional variation as a rack or whaletail, this is the only time it comes in second place.

SUMMARY

GOOD:
Light
Short
Quick on/off time
S/Steel capstan

NOT SO GOOD:
Two hands needed
Less frictional variation
Single rope only
Heats up easily

BOLTING IN CAVES

Alan Warild

Australian Caver 110 (1986)

A recent trip to Maydena has forced me to make a few comments regarding bolts in our caves.

I believe in placing bolts in caves. Once in, they make rigging faster, safer and lighter. The problem is that there appears to be an alarming number of people who have very little idea about how to best use bolts. This is not surprising, considering how little practice the average Australian caver gets in using them.

So possibly a few pointers are in order:

The position of the bolt is most important. After all, the main reason for using bolts is to put an anchor in a place where nature didn't provide one. Be especially careful to place bolts so that the rope will hang free below. In most cases you have wasted your time if you need a protector below the bolt where the rope goes over an edge.

One example to illustrate my point: The top of the last pitch in Dwarrowdelf probably has the worst case of "BoltRash" in Australia – 9 bolts when 2 or 3 would suffice.

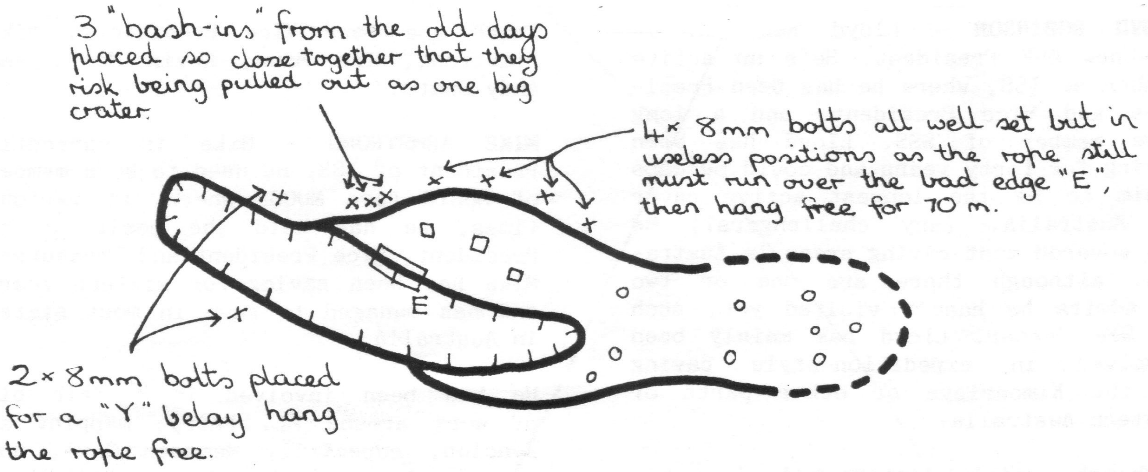
In this case the 7 bolts along the wall are unnecessary. Setting bolts can often be a "displacement activity" to avoid the "awesome drop below." Any of the 7 make a useful handline for getting on and off rope without interfering with the pitch above, so one of them isn't totally wasted.

With the exception of traverse lines to get out over the pitch it is well worth the time to "test hang" the rope from the proposed bolt position. Don't be afraid to hang out in some odd position for 20 minutes to place a bolt. I've seen people use 'skyhooks' to cling in impossible positions, just to get that 'perfect hang'. If you do your job well enough the next caver will have no option but to use the good rig-point you've provided.

While you're out there, take care to set the anchor properly. Before you actually set it, use the drill to "sculpt" the edge of the hole so that the anchor will lie flush, or just below the surface. (It helps to overdrill the hole by 1 - 2mm. Most new drivers are designed to let you do this.) Then smooth the surrounding rock so that the hanger will sit well. Do all this smoothing last so that you don't have to drill a hole with a blunt drill.

When you leave, take your hangers with you. In wet caves especially, they only increase corrosion of the anchor unless well greased. It is also helpful to take some tool (wire hook, sparkplug cleaner etc.) for cleaning out dirty anchors.

Finally, place bolts with discretion. Perhaps the best one is that which will never be found again. Normally it is best to place them so they are readily visible to avoid a later caver missing yours and putting another nearby.



AN INCIDENT AT GUY CAVE, KATHERINE N.T.

Guy Bannink & Karen Magraith

Australian Caver 130 (1992)

In October 1991 an incident involving severe dehydration and suspected hyperthermia occurred in Guy Cave on Cutta Cutta Nature Reserve, during a Top End Speleological Society trip. Fortunately the incident was not as serious as it could have been, but it served to illustrate some of the unique caving conditions and safety requirements of the Top End.

There were four people in the party, two experienced NT cavers and two novices who were present for scientific purposes. They were physically fit and were well acclimatised to the NT conditions. The purpose of the trip was to go to the water table to inspect and sample shrimp, and investigate rumours of the presence of blind fish.

Both in Darwin and before entering the cave, the NT cavers impressed upon the novices the dangers of hyperthermia and dehydration, and they were advised to have frequent drinks and rest stops. The party entered the cave at 9pm, as the air flow into the cave cools the deeper passages at night and the return journey to the surface would be less stressful. Approximately two litres of water per person was carried along with spare lights, and scientific equipment. At the water table conditions were expected to be extreme, with temperatures around 31 degrees and humidity about 98%.

The trip to the water table, about 800 metres into the cave, took about one and a half hours. Most of this distance involved crawling or difficult walking. Every twenty minutes the party stopped for a rest and a drink. During these stops the novices were encouraged to drink. One of the novices, insisted that he was not thirsty. It was noted that both novices' overalls were completely saturated. There didn't seem to be any problems on the way in and both novices commented that they felt comfortable but were quite hot.

There was no evidence of foul air at the water table and the group spent about an hour collecting shrimp specimens and waited for traps to catch fish. Most of the cavers spent this hour lying around in the dark, which allowed them to cool down and wait in relative comfort.

Before the return journey all water containers were refilled. Shortly after starting, the novice complained of thirst, weakness and feeling overheated. His overalls were completely saturated with sweat, whereas the experienced cavers' overall were only just damp. The other novice was also hot, but was otherwise well. The party stopped to drink water and rest to allow the person to cool and rehydrate. As the party was moving to the surface the ambient temperature was dropping noticeably. After a short crawl he began to vomit and was unable to move for some time. He was eventually able to continue slowly, with someone else carrying all his gear (and the vomitus!). On the route he continued to vomit, and was becoming dizzy and incoherent. A decision was made to continue to move as opposed to stopping and sending for help, because the temperature was dropping and an inflowing breeze helped to cool the party.

With some firm handling, slow progress and a change in the route the party made an exit after two and a half hours. It normally takes about 30 minutes for experienced cavers to reach the surface from the water table. At no time did the group run out of water. On arrival back at camp the casualty was very tired and uncommunicative and retired to his sleeping bag after having some oral fluids

Our assessment was that the person was significantly dehydrated, hypotensive, (low blood pressure) and probably had suffered hyperthermia. The next morning, he felt much better, but was determined that he would never enter a cave again! Despite this unfortunate incident, the trip was not entirely unsuccessful, as a new genus of shrimp was identified in the specimens collected at the water table.

Since this incident, TESS has changed its policy about which caves novices may enter, in order to prevent an incident which may be more serious next time. We have developed a set of safety guidelines, which includes a protocol for logging in and out of caves, and proposed guidelines for cave rescue in the Top End which take into consideration the extreme conditions in the caves and the dangers of dehydration and hyperthermia.

HEAT AND HUMIDITY IN THE TOP END

Karen Magraith and Guy Bannink

Australian Caver 131 (1993)

This is the second of the series on articles dealing with caving safely in the Northern Territory. This article looks at heat related disorders and their treatment.

With temperatures in the high twenties to low thirties, and the humidity usually over 90%, caving in the Top End is a strenuous exercise. The risk of heat stress and dehydration is always present and must be borne in mind on all trips.

The three heat related disorders which may occur are heat exhaustion, external heat injury and heat stroke. Heat stroke is the most serious of these, and is potentially fatal.

Risk factors for the occurrence of these problems include:

1) Temperatures over 35 degrees and humidity over 60%.

2) Increasing age.

3) Preexisting medical conditions, especially heart disease and diabetes.

4) The use of alcohol and certain drugs, including diuretics ('fluid tablets) and drugs used in mental disturbances.

5) Lack of acclimatisation to the tropical climate (this usually takes four to seven days).

Prevention

This is much easier than treatment.

1) Acclimatise to Top End heat before going caving.

2) Cave in the coolest part of the day.

3) Ensure adequate fluid intake, both before and during the trip. This must consist primarily of water

4) Rest frequently and don't over-exert yourselves.

It is easy to underestimate water requirements. Unless you drink regularly regardless of thirst, dehydration can occur very rapidly. We estimate that the average person moving through a cave would lose 500 to 1000ml of fluid each hour.

This point was illustrated to us in an experiment conducted on a Top End Speleological Society (TESS) trip. A group of TESS members measured body weights before and after a four hour trip, during which we all drank as much water as we normally would. I had been drinking frequently, and consumed almost two litres. At the end of the trip 1 had lost two kilograms, or 3.3% of my body weight. If 1 had not been drinking it would have been 6%. One caver was 5% dehydrated and would have been almost 10% if she had not been drinking water. Dehydration of 5% or greater usually necessitates hospital treatment, and levels of more than 10% can be life threatening. This exercise made us aware of the short time in which dehydration and death could occur in the case of cavers being lost or injured, or running out of water.

Recognition

Early recognition that someone is suffering from a heat related disorder or dehydration (which are very closely linked) is crucial to successful treatment.

Symptoms include:

headache, weakness, dizziness, chills, nausea and vomiting, muscle cramps, confusion, incoherent speech, rapid, shallow breathing,

cool clammy skin, (heat exhaustion or exertional heat injury) or hot dry skin (heat stroke), collapse and unconsciousness.

In the case of heat stroke, collapse may occur without any other preceding symptoms.

First Aid

The extent to which this needs to be taken depends on the severity of the symptoms.

1) Get the person to a cool place with good air circulation if possible.

2) Cool them down quickly as best you can. Wrap them in cold wet sheets. Cooling must be continued until the victim's temperature is 39 degrees or less. If there is no thermometer, keep cooling them until temperature can be measured, or they have fully recovered.

3) Give them fluids. Make the victim drink as much water as possible. Do not give salt or concentrated drinks (eg. Cola).

4) Massage the victim's arms and legs to improve blood flow and thus heat loss through the skin.

Although the heat related disorders described above occur uncommonly, TESS is conscious of the need to prevent heat stress and dehydration. When we go caving, each person must carry their own water supply. All cavers are made aware of the fact that thirst is not a good enough indication of the body's need for fluid and that they must drink regularly regardless of thirst. The party only moves as fast as the slowest, hottest person.

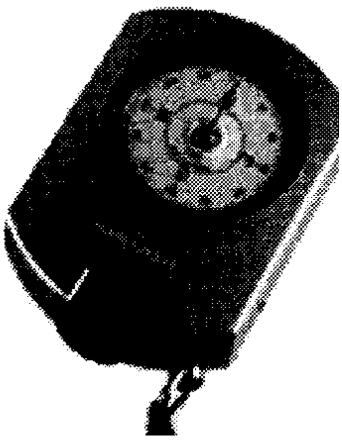
We impress upon all cavers the need to prevent heat stress and dehydration, and ensure that cavers are aware of relevant basic first aid measures. These factors are all especially important in the event of a rescue.

SUUNTO COMPASSES – TIPS AND TRAPS

Ken Grimes (Convenor: ASF Surveying and Mapping Standards Commission)

Australian Caver 141 (1997)

I think that most Australian cave surveyors use the SUUNTO KB-14 series compasses, and the matching PM-5 clinometer. These are compact rugged units, but there are some potential problems in their use that you must be aware of.



Sighting through the SUUNTO.

If you use a SUUNTO KB-14 series compass in the manner usually recommended you may find you are getting errors of several degrees in your bearings.

The "recommended" Two-Eye Method involves looking into the eyepiece of the compass with one eye and simultaneously looking with the other eye past the compass to the survey station. One's brain sees an image of the compass scale superimposed on the image of the station. The alternative One- Eye Method involves shutting one eye and alternatively looking through the compass eyepiece and over the top of the compass towards the station. With experience one can get a position where both the scale and the distant target can be seen simultaneously. This second method would seem less accurate but an experiment suggests otherwise.

Some time back I collected data at a UQSS S&T day. A group of 14 cavers took sightings at three distant features. Twelve used the recommended two-eye method, with first the left and then the right eye looking into the compass (the other two knew they had eye problems that made it impossible to use this method). Six of them then took sights using the one-eye method, looking over the top of the compass.

I averaged the results to get the presumed correct bearing for each feature, and calculated "errors" as differences from this mean. The standard deviation from the mean was about one degree for each station.

The Two-Eye Method was decidedly less accurate than the one-eye method for most people. 12 people (6 experienced surveyors, and 6 novices) took a total of 66 sights using the two-eye method. The average error (difference from the mean) was 1.1 degrees, but the maximum error was 3.8 degrees – this latter was from an experienced surveyor, who was however aware that he had one eye dominant over the other, and who normally used the one-eye method. There was little difference between the experienced cavers and the novices. However some novices initially made gross errors due to reading the scale in the wrong direction (I was the first to sight in each case, so I spotted these errors and showed them the correct way - which is right-to-left). Some novices also made gross errors with the clinometer reading in the wrong direction, or reading the 'percent grade' scale.

The One-Eye Method was more accurate, though one must remember that this was tried only by the six experienced cavers. The average error for the 6 people that did the one-eye method was 0.5 degrees, and the maximum error was 1.2 degrees. Again, the maximum error was from an experienced surveyor! But, not the same one as above. However, it was only in one of his three readings so perhaps he had an intermittent glitch?

The problem with the two-eye method would seem to be that some (many?) people have "lazy eyes" which do not always point in parallel directions. The problem becomes worse when one is tired – i.e. in the second half of a long surveying trip! I have this problem myself – possibly a result of many hours spent looking at stereo air-photos, where one deliberately swivels ones eyes in different directions!

Surveyors using Suunto compasses (and that is most of us) should check their own eyesight - trying both methods (and trying both left and right eyes to the compass window in the two-eye method). If you tend to get significant differences between the methods or between left and right eyes in the two-eye method then perhaps you should change to the one-eye method.

There is a SUUNTO model that has a prismatic housing mounted on the top. I am told that this is not as easy to use as the usual model, but it might be more accurate if used one-eyed.

Lighting the SUUNTO.

As with all compasses, one has to be careful not to bring magnetic or ferrous objects close to them. There was also a suggestion that the current through a light bulb might generate a significant magnetic effect. I experimented with my cave lights. My electric cap light had no effect when worn in the usual position. Switching it on & off made no difference. From this position it is possible to light the compass by holding your hand above and partly in front of the light so that some of the photons are bounced down onto the card – it helps if you have a clean hand! Moving
the cap lamp closer to the compass caused a deflection when it got within 5cm.

My Premier (hand held) carbide light started to effect the compass if held closer than 35cm. The brass helmetmounted carbides might be better.

Both my backup battery-powered pencil torches caused strong effects (regardless of whether they were turned on or off). Depending on just where you held it the effect could be seen while the torch was up to 15cm away from the compass. One torch had a metallic case (but I think it's aluminium) and the other was plastic but both gave similar effects. After a bit I thought to try a penlight battery (alkaline type) on its own. It also gave a strong effect - similar to that of the torch. There is a polarity effect - one end of the battery is north, the other south. So in effect any battery powered torch should be kept well away from a compass and not used for reading it!! With experiment I found that the effect was minimal if I lowered the torch vertically so it was exactly above the centre pivot of the compass card (i.e. the magnetic field was even on all sides of the compass) - but I would not rely on being able to do that accurately in a cave! I do not have a PetzI Zoom or similar unit with helmet-mounted battery. If you do, it might be worth testing it. In theory, a battery pack mounted at the back of a helmet should be more than 15cm from the compass, and also the 4 batteries usually mount in alternating directions and so might tend to cancel each other - but test your own unit.

Candies & cyalumes should not be a problem!

SUUNT0s with internal lights.

I have just bought a SUUNTO (KB- 14/36ORB) which has a built-in battery light. I have yet to use this in a real cave survey, but I tested it at home. Switching its light on and off had no effect. Removing the battery pack had no effect. This is as one would expect - obviously SUUNTO have done a proper job on the design. The battery is a tiny (match-stick diameter) thing with a match-head sized bulb at one end. You press a rubber button to turn it on. The light & battery unit plugs into a hole in the side of the compass and is held in place by the friction of the rubber seal. I was uncertain about how water-proof this would be, but a Tasmanian user at the recent ASF conference indicated that he had had no problems in wet Tassie caves. I am not sure how long the battery lasts. I intend to extend its life by using my hand over my cap lamp to light the unit whenever I can, and only resorting to the internal light when that is impossible.

SUUNTO also has a KB-14/360RT compass with a Tritium "light". Tritium emits "soft" beta particles which cause fluorescence of a coated plate mounted above the card. A user at the ASF conference said that this light source was a bit weak, but the intensity of the glow could be enhanced by holding it in front of one's helmet light immediately before use. I once used a different brand of compass with a tritium light and found the light OK, but the compass itself was not! Note, that the tritium light becomes weaker with time (tritium has a half life of 12.5 years - so the light intensity will halve over that time).

These lighted versions of the SUUNTO cost about $50 more than the standard model, but are worth considering as they avoid the problems of magnetic effects from other light sources.