Backcountry Skiing

A 5 part Series by Emerson Sanford

This series of articles originally appeared in “The Breeze” - the newsletter of the Edmonton Section of the Alpine Club of Canada and is reprinted courtesy of Emerson Sanford. Emerson is the Winter Chairperson of the Edmonton Section of the Alpine Club of Canada. Portions of this article refer to locations and establishments which are local to Alberta, Canada. In order to retain the original intent of these articles, such references have remained unchanged and readers are urged to contact experts familiar with their own locale to decide what similar locations and facilities may be available to you.

This series of articles will be provided in two packages. Initial Preparations & Fitness and Clothing & Equipment will be available in the first package. The remaining three articles on Shelters, Transporting the Injured and Avalanches will be available in the second package. Further information on training courses as well as additional copies of this and other articles and technical notes can be obtained directly from Rescue Dynamics at 5109 - 17A Avenue NW, Edmonton, Alberta, Canada T6L 1K5 [phone / fax (403) 461-5040]. Email can be sent to *resqdyn@compusmart.ab.ca* On the Internet, visit the Rescue Dynamics World Wide Web Site at - http://www.compusmart.ab.ca/resqdyn/

Backcountry Skiing. III.
Emergency Shelters

Article 3 in a 5 part Series

Winter Chairperson - Alpine Club of Canada - Edmonton Section

The previous article in this series dealt with the clothing and equipment suggestions for a first time skier to enjoy a backcountry ski-touring trip. Perhaps one of the most frightening aspects of ski touring is the thought of having to spend an unplanned night outside as a result of getting lost, making a poor estimate of the time required to return to shelter, having a party member who becomes over-tired or who cannot keep up, or having one or more members of the party become injured. If the equipment and clothing guidelines in article II are followed, survival during an unplanned overnight stay, even in severe winter conditions, should be possible provided that you know how to build an emergency shelter.

This article will provide instructions for building several types of snow houses which will allow a group to survive the night in an Alberta winter. However, just reading this article will not suffice; you must practice under non-emergency conditions. Some of the shelters can be built in the city, others require hard packed wind driven snow normally found only in the mountains. You can often find an example of one of these types of shelters in a small park across the road from my home in South Edmonton. At the time of writing, there is a one-person (cozy two-person) snow cellar in the park. The availability of this shelter for spending the night is on a first come-first served basis!

Quinzees.

Probably the most popular type of snow shelter is the quinzee. Building a quinzee consists of making a pile of loose fluffy snow approximately 3m in diameter and 2-3m high, then allowing the snow to strengthen for approximately one hour from the time that snow was first piled on the base. When loose snow is disturbed, it consolidates and becomes very strong (check the snow where you cleared your sidewalk at home). Once the snow has settled, it can be hollowed out by cutting a hole in one side and proceeding to remove snow from the inside.

Make the initial inside cavern full height and quite narrow, leaving at least 0.3m thickness all around. Branches from a tree of the correct length can be pushed into the pile from the outside and used to judge the thickness of the walls. Work carefully so that the structure does not collapse. It takes several hours for the snow to achieve full strength. The final structure will resemble a traditional igloo. A small ventilation hole, no larger than a ski pole and perhaps smaller, should be made in the roof. A cutaway view is given in Figure 1.

In making the pile, it is important not to use lumps of snow because these will not consolidate to form a strong structure. Also, corn snow or depth hoar will not consolidate and will weaken the structure. If the initial base snow is less than 1m in depth it is often best to tramp the snow within the 3m radius of the quinzee first before starting to make the pile. If this is not done it simply means that the structure will settle more that otherwise. If the snow is more than 1m deep, tramping the snow is too difficult and normally not worth the effort. Making the pile will take 20 to 40 min. depending on the number of people and the snow conditions. The size required is dependent on the number of users and the situation. If it is purely for an emergency, the smallest shelter which will allow everyone to get inside and sit with their legs outstretched is desirable. Under these conditions, a 3m external diameter structure will have an internal diameter of 2.3m and will accommodate 6-8 people sitting huddled close together for warmth. Snow shelters for winter camping are usually larger and often include a raised platform for sleeping.

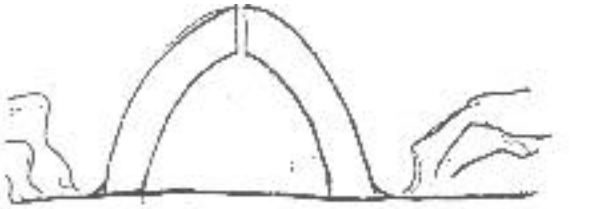


Figure 1. Cutaway view of a Quinzee

Figure 4. Snow Trench

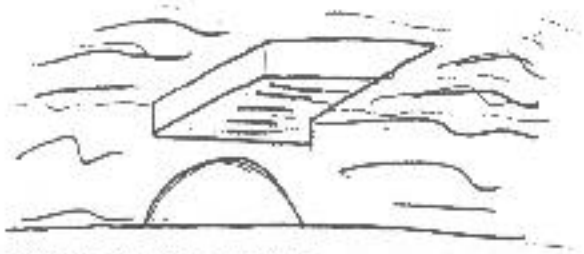


Figure 2. Snow Den

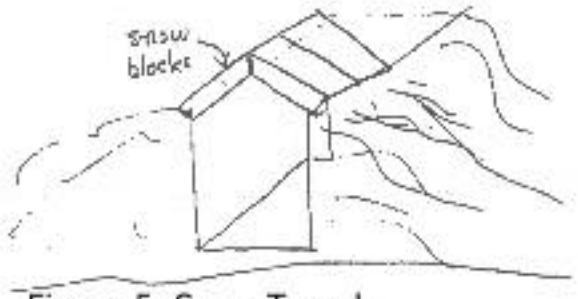


Figure 5. Snow Trench covered with snow blocks

Figure 3. Snow Cellar

Snow Den.

The second type of shelter, which I have called a snow den, can be built very quickly in deep powder snow and would normally only be suitable for lying down. The snow should be at least 1.3-1.5m deep for this type of structure. First, with your skis on, pack an area of undisturbed snow the length of the skis and approximately 3m in the other direction, by sidestepping. This will pack an area 2m by 3m and will pack the snow approximately 15 cm deep. An illustration is given in Figure 2. The purpose of packing the snow by sidestepping with skis on is to consolidate the snow to give it strength. If this is not done, the roof will sag noticeably. A hole can now be dug in front of the packed area and the area under the packed snow hollowed out to a depth of 3m to provide a shelter. This can easily accommodate at least 2-3 people in an emergency, depending on the depth of the snow. Leave the roof at least 30 cm thick. It is not necessary to wait for the snow to consolidate for this structure, so building it is very quick. The main requirement is deep snow, often readily available in the mountains.

Snow Cellar.

A similar structure can be built when the snow is not very deep by piling the snow up to look like a half-log (Figure 3). I have called this a snow cellar because it reminds me of potato cellars in PEI. Piling the snow takes one person approximately 20 min. After another 40 min. to give the pile a chance to consolidate, it can be hollowed out to form a shelter, again only suitable for lying down. It is easiest to hollow out the pile from both ends since it will not be very high, probably .6m at most. Once it is hollowed out, simply take some of the snow that has been removed and seal one end. This type of structure is particularly good if there is not much snow available.

Snow Trench.

If the snow is reasonably hard, but not necessarily hard enough to cut good blocks, an emergency shelter can be constructed very quickly by simply digging a trench approximately 1m wide, 1m deep depending on snow conditions, and 2m in length (Figure 4). If the snow is soft, lay ski poles lengthwise along the top of the trench, then put skis crosswise over the top as shown in the diagram. Three pairs would be enough. The top can then be covered with whatever is available, a ground sheet, a bivy bag, bivy sacks, foam pads, garbage bags, etc. If these are not available in sufficient quantity, boughs from spruce or fir trees can be used. Once the top is covered, snow is placed on top to form an insulating roof. Again, this type of structure can accommodate 6-8 people sitting huddled together with legs outstretched. In hard snow, the trench can be covered with snow blocks (Figure 5), if a means is available to cut the blocks. Skis can sometimes be used if a snow saw is not available. I will describe how to make your own snow saw at the end of this article.

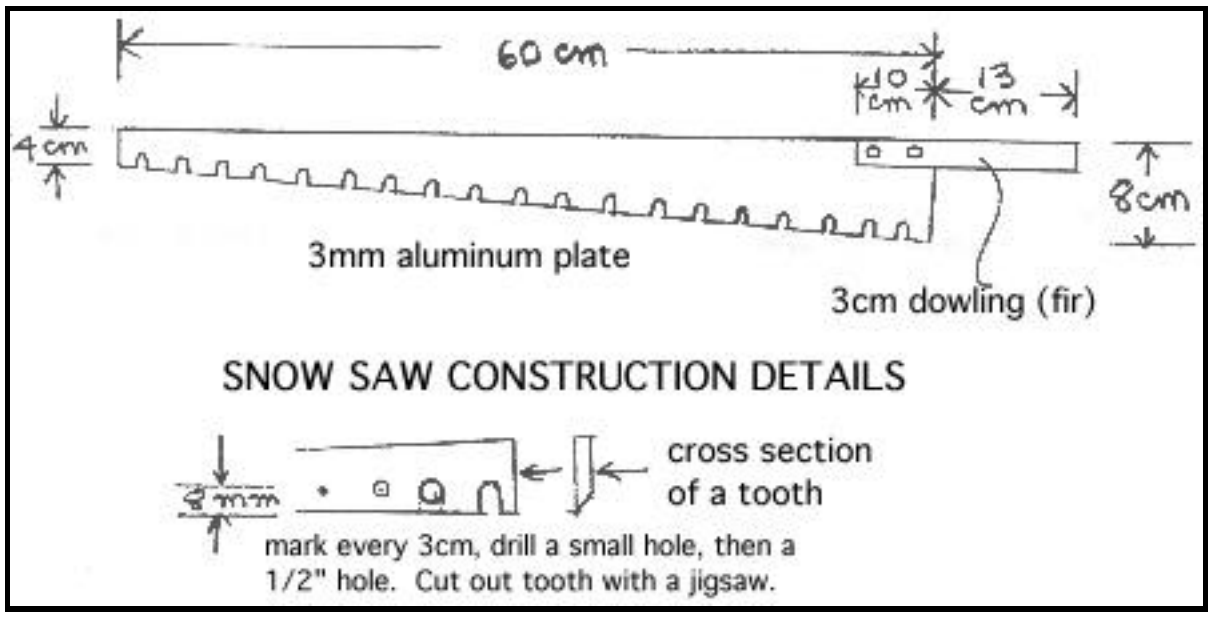
Snow Cave.

The final type of structure, a snow cave, can be constructed if deep, hard, wind-blown snow is available. In the mountains, this type of snow is found in open or hilly areas where the wind can pile up the snow. In open areas, the snow appears as a drift. On hillsides, deposited snow can often appear to be just a hill, but testing with a snow probe can reveal snow of considerable depth. When this type of snow is available, constructing a shelter consists of simply digging a cave in the side of the drift or hill. Although this sounds easy, the snow is usually very hard and digging is neither quick nor easy. A snow saw makes the job much easier.

To summarize, an emergency snow shelter can be built using only a shovel, in almost any type of snow conditions encountered in the mountains. The first step is to assess the conditions and to decide what is quickest and best for the circumstances and snow conditions. In an unplanned overnight stay, the warmest shelter will be the smallest one which can accommodate everyone huddled close together. Burning a candle inside a small snow shelter can provide considerable warmth, especially if the opening is sealed as much as possible by piling packs in the opening. Always take your snow shovel inside the snow shelter with you in case the wind covers the opening with snow during the night and you have to dig your way out.

Making a Snow Saw.

The tools required to build a snow saw are a jig saw with a metal cutting blade, a drill with a 1/2 inch and a small drill bit, a grinder, a round file and a flat file. Cut the shape of the saw from a sheet of 3 mm aluminum plate (see diagram). I obtained my aluminum plate in Nova Scotia from a company that builds fire trucks. Machine shops or Atlas Alloys in Edmonton should have the plate. Next, mark the position of the holes, drill and cut out the teeth. Saws often have the teeth closer together than this. The distance is not critical and more teeth is more work. After cutting out the teeth, grind the metal between the spaces on a 45 degree angle as shown, alternating each one. The handle can be any shape that you want but a piece of 1 1/4 inch doweling works well and is easy. Use a hand saw or the jig saw to cut a slot in the dowel and drill two 1/4 inch holes to fasten the handle to the saw. Countersink both the head and nut on the bolt to make a smooth finish. My saw weighs 350g.



Backcountry Skiing. IV.
Transporting the Injured

Article 4 in a 5 part Series

Winter Chairperson - Alpine Club of Canada - Edmonton Section

The third article in this series showed how to build emergency shelters which would allow a party, who was not equipped for spending the night outside, to survive. One of the reasons why a party may have to spend an unplanned night outside is injury to one or more members. Sometimes an injured person can be transported to warm accommodation if a suitable means of transport can be constructed, if time is available for transport and if conditions are suitable. Often the best that can be accomplished is to transport an injured person to a safe place where shelter can be built while waiting for help. This article will deal with possible means of transport and provide a plan for building your own toboggan frame.

First Aid Training.

It is imperative that someone in the group is fully trained in first aid. A discussion of first aid skills required is outside the scope of this series of articles. Each year, the Edmonton Section of the Alpine Club offers first aid courses, taught by Cyril Shokoples, who is a qualified Emergency Medical Technician and is also a licensed mountain guide. Cyril has used his combination of skills to design a first aid course especially for mountain travelers, and the course is highly recommended. Other first aid courses are available from other sources. The first aid courses will help you decide if the injured person can be transported, how far, and what type of transport is desirable.

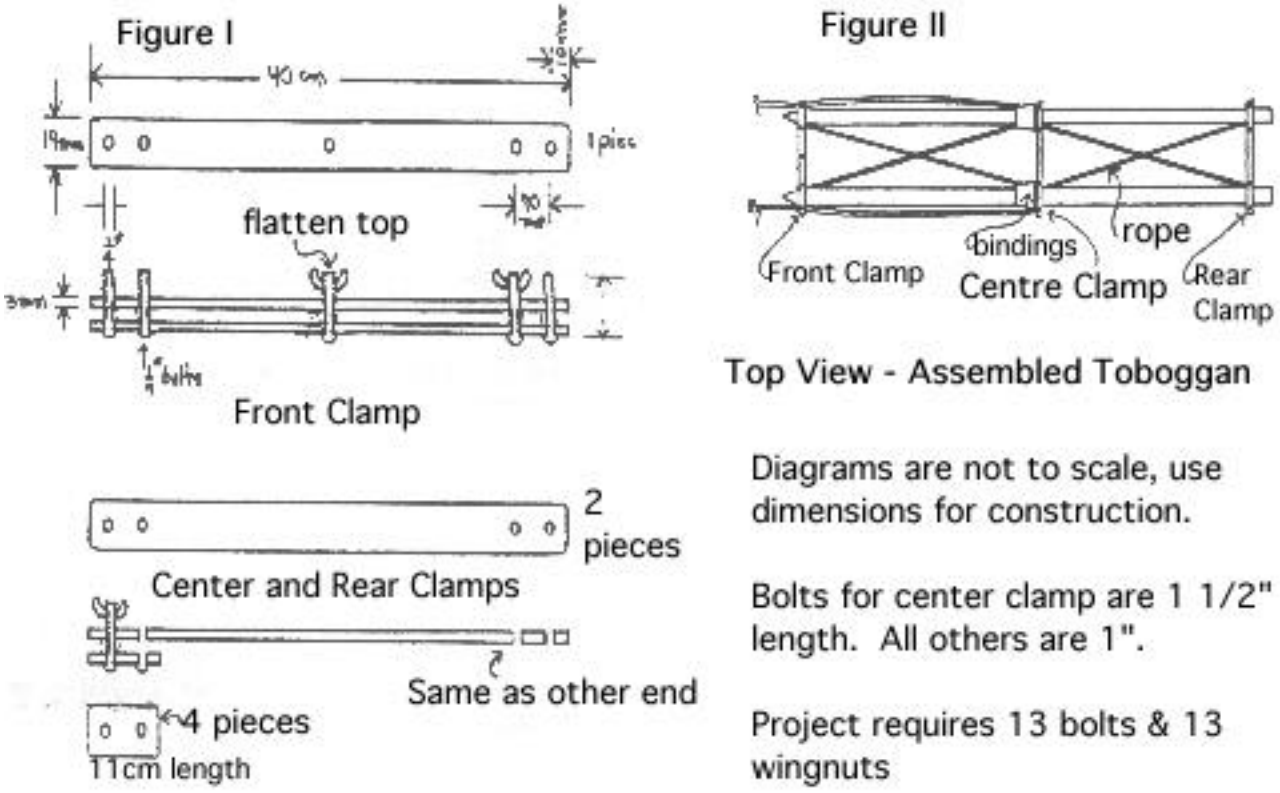
Bivy Bag.

For novice skiers, transporting an injured companion could vary from transport down a gentle telemark slope which has one meter deep powder, transport from the site of an avalanche over a hard packed avalanche path, or transport on a packed trail. The method used will depend on the conditions, the type of injury and the equipment available. If the injuries are broken bones in the limbs, severely sprained ankles, knees, etc. which can be splinted, an easy means of transport is often to place the injured party in a bivy bag, attach ropes and simply drag the person through the snow. This method is very fast to get started and works particularly well in deep powder especially when going downhill. The ride would be rather rough on a packed trail or over a hard avalanche path.

Skiers often feel that it should be possible to make a toboggan from the injured party's skis and use that for transport. Anything can be tried in an emergency but unless a system has been devised and practiced ahead of time, the chances of success are rather small. I am going to describe a set of clamps which can be used to make a suitable toboggan from the patients skis. An additional set of skis can be attached with tape or rope to make an improvised backboard if necessary. The clamps can be made easily at home by most people. The design is adapted from the design of a set of clamps that was available from the Canadian Ski Patrol Nordic Division several years ago.

Making Toboggan Clamps.

The equipment required to make the clamps is an electric drill, 1/8 and 1/4 inch drill bits, a center punch, a hack saw and a file. The aluminum strips, the bolts and the wing nuts can be purchased from the Revelstoke store on the Calgary Trail at 45th Ave. for about $15.00. Cut the strips and drill the holes according to the dimensions in Figure I. The holes should be spaced far enough apart to accommodate "fat" telemark skis. Use the file or a grinder to smooth off any sharp corners. The toboggan can be assembled without removing the wing nuts by backing them off all the way and sliding the clamps on the skis (Figure II). Be sure to put the center clamp with the longer bolts to accommodate thicker skis on before the rear clamp. It is a good idea to flatten the end of each bolt, with the nut on, to prevent the nut from accidentally being removed and lost.



Once the clamps are in place, strengthen the system by crossing rope as shown in Figure II. Start at the back and securely fasten the rope around the rear clamp. Lead the free end to the binding on the opposite side and securely wrap the rope around the clamp or the binding. Proceed with the free end to the opposite front clamp and fasten again securely. Go across to the opposite tip, fasten, then go back to the other binding and on to the rear of the ski. This will both make the system rigid and provide some support for the patient. Ropes for towing the toboggan should be attached directly to the bindings since they are securely attached to the ski. The rope should then be passed through the front clamp, but not attached to the clamp. This will keep the rope from sliding under the toboggan. Sometimes a shovel can be fitted to the front of the toboggan, with the handle up, to aid in travel through deep snow. Some snow shovels have holes predrilled to facilitate this type of attachment. If a foam pad of any sort is available it should be placed on top of the toboggan, then the patient. If a bivy bag is available, place the patient inside the bivy bag. As a minimum, padding will have to be provided over the bindings. Tie or strap the patient to the toboggan.

With this system, each non-injured person has a pair of skis, and can help tow the toboggan. On side hills or going down a steep hill, a rope may need to be attached to the back for stability. As with any safety equipment, it is important to practice at home in a non-emergency situation.

In conclusion, first aid training will allow backcountry skiers to assist an injured companion and determine if the person can be moved safely. Often the patient can be moved in either a bivy bag or a simple toboggan made from the patients skis. It may be possible only to move the injured party to a safe spot where shelter can be constructed while waiting for other means of transport.

Backcountry Skiing. V.
Avalanches

Article 5 in a 5 part Series

Winter Chairperson - Alpine Club of Canada - Edmonton Section

Everyone who goes into the backcountry in the winter is eventually faced with the reality of route-finding, which often means choosing a path of travel which is the least likely to take one through dangerous avalanche territory. There are no easy rules to help one decide if a slope is stable or not. Certainly everyone who goes into the backcountry, except perhaps those who stay on groomed trails which are advertised as being safe from avalanche hazards, should have taken an avalanche safety course. There are many courses available, including some given through the Edmonton Section. The course instructor will provide information on how to access and use avalanche bulletins. The course material can be supplemented by reading books on the subject. Two good ones suitable for this area are:

- Daffern, Tony. Avalanche Safety for Skiers and Climbers. Rocky Mountain Books, Calgary, AB.
- McClung, D.M. and Schaerer, P.A. Avalanche Handbook. Douglas McIntyre, Vancouver, BC.

The next step after taking a course and reading up on avalanche hazards and route finding is to go on trips with experienced leaders. Learn from them how to decide if a particular route is likely to be safe and how to deal with the situation when there is no choice but to either cross a slope which may be unstable or turn back.

Transceivers.

It follows naturally from the above discussion that essentially everyone going into the backcountry in the winter should wear an avalanche transceiver and be experienced in carrying out a search using the transceiver. Make sure that the other members in your party are experienced in search techniques and test the transceivers each morning as you start out on your daily trip. Transceivers can be rented from the Alpine Club and from the Campus Outdoor Center.

Snow Shovels.

Finding a buried companion using a transceiver does little good unless you have the ability to dig the person out quickly. In any party, two or three people should carry snow shovels, and preferably everyone. It may be possible to dig a person out using skis and hands if the person is not buried very deep and if the snow is not two hard. However, without a shovel, it may take to long, and time is critical in a situation such as this. Shovels sold in sports stores as avalanche shovels are usually strong enough to stand up to digging hard packed snow and are made of plastic or aluminum which makes them lightweight. They are also expensive which often deters skiers from buying them. Avoid plastic shovels sold in hardware stores, etc. They are inexpensive and light weight but usually not strong enough for either digging someone out of an avalanche or digging a snow cave in wind blown snow. Test a new shovel by digging in a snow bank piled up by a snowplow several hours after the snow has been piled up. Aluminum shovels sold as car shovels are often a reasonable alternative to the expensive avalanche shovels. Grind off the rivets holding the handle to the blade and drill out the hole to 1/4 inch and replace the rivet with a threaded bolt and wing nut. In this way the handle can be removed for carrying in the pack.

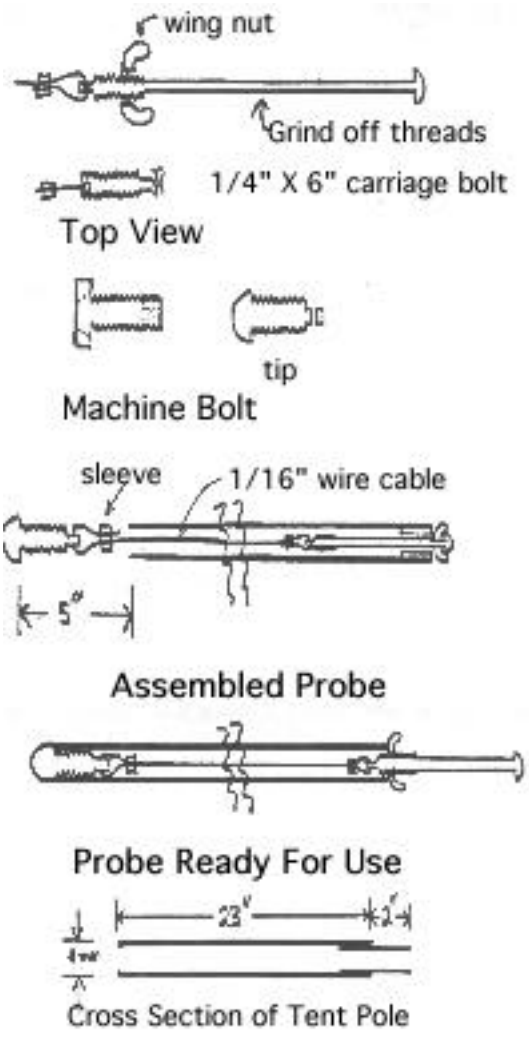
Avalanche Probe.

A second piece of equipment that should be carried by at least two people in each ski party is an avalanche probe pole. After locating a buried person with the transceivers, a probe pole allows one to quickly determine the exact position of the body and save precious time in digging the person out. Some ski poles can be screwed together to form a probe pole, and these are useful but far from ideal because the diameter of the poles varies with length and can limit their use in hard packed snow. Commercial probe poles are 10 to 15 mm in diameter and when fastened together form a smooth surface over the entire length of the probe, which is usually three meters. Probe poles weigh approximately 300g so they are light weight, but cost around $100.00, which is why few people own them.

Peer Pressure.

I have designed a probe pole from tent poles which can be made by most people at home and will cost less than $40.00 to build. Before describing how to build the probe, there is one other item regarding route finding and avalanche hazards which needs to be discussed and is perhaps the most important item of all. Professional mountain guides have stated that the single biggest danger in skiing in the mountains in winter may be peer pressure. In every crowd, there is always one outspoken individual who says in a loud and convincing voice that "it is safe, lets go". Evaluate for yourself whether or not you feel that a particular activity is safe and have the courage to say "no, I'm not going" if you feel that the risk is to high. If you do not feel that you have the knowledge and experience to decide if a particular route is reasonably safe, go with someone who you trust, but pick your mentor carefully. There are no guarantees, and every trip involves some risks, but reasonable decisions can limit the danger.

Building a Probe Pole.



The tools required to build a probe pole at home are a grinder, a drill with a 1/16 inch drill bit, a hack saw and a pair of pliers. Some epoxy glue is also required. The details are given in Figure I. The bolts, cable, and cable sleeves were purchased at Revelstoke hardware on Calgary Trail. Buy steel cable from the bulk roll, not picture hanging wire. First grind down the carriage bolt as shown such that the wing nut will easily slide along the shaft of the bolt. Also grind off the square shank at the top and decrease the diameter of the bolt head such that the wing nut will slide up as far as possible. It is not absolutely necessary to grind down the threads as the wing nut could be threaded all the way to the top each time. However, following the design will make assembly of the probe much faster, especially when trying to assemble it in an emergency situation with cold hands. Flatten each end of the bolt by grinding, drill a 1/16 inch hole in the bolt and secure the cable to the bolt with a cable sleeve, after putting the wing nut on the bolt as shown (reverse of normal position). Grind down another bolt, approximately 1 inch in length, to form the tip.

The probe shown here was made from five sections of black aluminum tent pole purchased from Totem Outfitters, each 23 inches long. The inside sleeve which is used for joining the pole sections together was 2 inches long when purchased and was cut down to 1 inch on four of the poles and cut flush with the pole on the fifth section. Assemble the probe as shown in the diagram with the bolt and wing nut fully inserted in the top. When this length of pole section is used, an extra 5 inches of cable is required to allow disassembly of the probe. Attach the cable to the tip as shown, with exactly 5 inches between the tip and the pole end. Once the cable is attached, test the probe to see if it can be disassembled and folded. If this checks out, use epoxy glue to seal the tip in the end of the pole section. The probe is now complete and ready for use. If you use shorter pole sections, and require more that 5 sections to obtain the

length that you desire, remember that it takes 1.25 inches of bolt length above the threads for each extra section, and 1.25 inches extra distance between the tip and the pole end for each extra section. Tent pole sections with tapered ends can be used but the surface of the pole will not be smooth when assembled and the pole will not be quite as rigid.

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