

Part 6: Emergency Response

Learning Outcomes

- Recognize that Companion Rescue is a last-resort response, not a preventative measure of risk reduction, nor a justification for poor terrain choices.
- Explain what to do if caught in an avalanche.
- Outline all steps of the AIARE Avalanche Rescue Quick Reference card.
- Set up a realistic mock rescue scenario.
- Organize and carry out small party companion rescue, including:
 - Ensure the safety of the rescue party.
 - Lead an efficient search for multiple victims using different numbers of searchers.
 - Follow a transceiver search pattern to locate single and multiple burials.
 - Target a burial site with a transceiver and probe, both alone and with a partner.
 - Efficiently dig out a buried victim from 2-meters deep.
- Describe the utility and limitations of avalanche rescue and safety equipment.
- Recognize the requirement of pre-event practice and emergency checklist use to increase likelihood of survival.

The AIARE Decision Making Framework suggests that each team “Plan Emergency Response.” The reality is that getting caught in an avalanche can be violent, gruesome and heartbreaking. Even with modern technology, average response times are nearly 18 minutes to get buried victims on the surface. Compare that with a huge drop in survival rates at about 12 minutes of burial time. On average, it doesn’t look good if you’re fully buried; 52% of fully buried victims die. In Colorado during the winter of 2010/11, 10 people were reported fully buried, 7 died.

Trauma is no small matter either. One quarter to one third of avalanche fatalities are due to traumatic injuries, not from asphyxiation. If your partners have to dig you out consider the following. A 3-foot deep burial (less than average) requires moving at least 2,500 pounds of snow. A 6-foot deep burial requires moving no less than 10,000 pounds of snow. You’ve got minutes to get the job done, and you still have confounding factors of keeping the rescuers safe, the challenges of communication and access to the debris (with people potentially spread across a mountainside), understanding the technical details of your transceiver and the overwhelming stress of having a partner dying beneath the snow. If it’s not clear yet, consider that companion rescue isn’t something you want to ever have to do.

Bottom line: companion rescue is a daunting and challenging task. The upside is that training can improve response outcomes. Take Canadian Mountain Holidays for example. Their highly trained guides have an average response time of 8 minutes (granted they have helicopters too). Each winter, many lives are saved by efficient avalanche responses. Some undoubtedly go unreported, so it’s difficult to know the exact numbers. Read the accident reports on avalanche.org or avalanche center websites and you’ll hear of plenty of near misses, with disasters averted by quick responses.

6.1 – Avalanche Response

WHAT TO DO IF YOU ARE CAUGHT IN AN AVALANCHE:

Action taken in the first two seconds could save your life:

- Yell. Call out for attention.** If another group member can establish a “point last seen” your chance of being quickly found increases.
- Try to **quickly exit** to the side. Snow moves slower on the edges of the avalanche. Often a diagonal trajectory down and towards the edges of the avalanche offers the best chance of escape. If you are just below the crown, you may be able to exit upslope off the moving snow, or with shallow slabs anchor yourself to the bed surface.
- Deploy your avalanche balloon pack.** The sooner you pull the trigger, the sooner the avalanche balloon pack can do it's job to bring you to the surface and reduce the chance of impacts.

If your escape fails:

- Discard equipment:** skis, poles, snowboard, snowshoes. Keep your daypack on to help shield your spine; consider ditching a larger pack that may drag you down.
- Try to **grab trees and rocks** to slow yourself down and allow snow to slide past you.
- Kick, swim, and fight** to stay on the surface and move toward the side of the slide path. If you feel “out of control” in a fast moving, turbulent avalanche, curl into a ball and keep your arms and legs tucked in to protect yourself with your hands close to your face (try to grab your helmet, hood or collar).

As the avalanche slows:

- Thrust and kick to the surface** just before the snow comes to a complete stop. You might be near the surface; exposed hands or limbs increase the likelihood of a quick recovery and an air passage.
- Protect your airway.** Try to **push the snow away from your face** to make a larger airspace. Recent anecdotal research shows that keeping your hands close to your face, rather than swimming, during the turbulent phase of the avalanche provides the best chance of making an airspace in front of your mouth and nose.

When the avalanche has stopped:

- Try to **dig yourself out.** Call out when rescuers are near. **Stay calm.**

REALITY CHECK: NICK DEVORE, PRO BIG MOUNTAIN SKIER

April 28, 2011, Nick DeVore triggered, tried to escape from, and was caught in a small wet slide near Aspen, CO.

After the accident Nick posted on Facebook:

"Well...Its official. I'm laying down in my hospital bed with a broken femur, they fixed it with a titanium rod and a few screws. A small wet pocket ripped out as I jumped a cornice into this steep but short line. I almost skied out, but a small slide sucked me in and sent me flying toward a protruding boulder where I broke my femur. I tomahawked and rolled and slid with the wet slide until I finally came to a stop and was just able to remove the snow from around my face. Only my head was popping out. The pain was far beyond what I have experienced. After about two hours the helicopter came in and took me to Aspen Valley Hospital where I will be chilling for a while... Thanks for all the love and the incredible rescue performed by my friends and the heli peeps and the hospital!"

Powder Magazine's Tim Mutrie interviewed Nick to get more details on the accident, below are a few quotes from Nick: (read the full interview at <http://www.powdermag.com/mantle/break-a-leg/>)

"I'd skied Pyramid the other day and I'd been psyched to ski some more big lines. But the storms kept rolling in. Thursday came along—first bluebird day in a long time—and we knew there was high avalanche danger, so we went out to the M&M Chutes. They're short, but steep."

"I was up there with my friend Jake and he's been to AK before. And it's like, when you've skied huge lines with big exposure, these little lines aren't as scary—if something rips out, you can just out ski it. We saw a large fracture avalanche on one of the chutes nearby, from the day before I think. But it was beautiful. I even remember Ian and Chris, down at the bottom, they radioed up: 'Are you guys gonna dig a pit?' And we said, 'No, we're just gonna send it.'"

"Some of the lines are going to be sliding, and that's an element we're used to. I mean, the avalanche here was something that would be called 'manageable sluff' in Alaska. ... So we all skied one run, no worries, and the snow was thick and buttery. Then we went to these steeper lines that were slightly more east-facing and had a cornice drop to get in. It was wind-loaded and had been kinda sun baked. It was really kind of obvious. And that's the case every time I'm in a situation like this—it is obvious. All the signs were there beforehand. I even kinda knew beforehand, just kind of neglected it."

"So because of the size of the line and the lack of gnarliness there, we sort of overlooked potential hazards."

"That's how skiing the backcountry and life in general goes, right when you start to overlook the hazards or think you're bigger than that or can handle that, that's when accidents happen... your confidence level maxes out and you forget you're just a small thing in the big natural world. That confidence is also the thing that drives skiing and other sports. But when confidence level gets too high you also forget about the dangers."

"Dropping in, it was a snow type that I didn't expect. It ripped and it was almost like a mud slide; sucked my ankles into it. I was almost able to ski out of it. I was trying to battle it."

"The crown was 6 to 18 inches max, just the new recent storm snow. It probably fell as a few feet of snow and had baked down to that. It felt like there was a fairly hard icier layer under that... The chute sort of doglegs to the right, but the fall line went right to a protruding cliff. I knew the rock was there and I was hoping I was just gonna miss it—my vision was obscured—but I didn't. I pretty much hip-checked the cliff. I thought I broke my hip. I just smacked it."

"I knew I had broken my hip or something, but I was battling the slide, I was tomahawked, then head down, and that was really scary, then head first. I totally lost control in the avalanche. But then I was on my feet and back and swimming down this mudslide. As the slope started to get less steep, I felt it slow down, and I just kept both of my hands free and I was moving snow away from my face. I had a nice face pocket."

"It's interesting watching the Go Pro footage because I wasn't really freaking out, but there I was, stuck, up to my neck. I wasn't really feeling the pain yet. Both my skis were still on, and my feet were torqued in an awkward position. Chris was on a snowmobile and he high-marked up super quick and shoveled me out, but he wasn't in a serious hurry because I could breathe and talk to him. The first thing—and I only know this from the Go Pro—he said was, 'Are you OK?' And I said 'Not really. I'm pretty sure my hip's broken.'"



Photo: Ian McLendon

AIARE thanks Nick, Tim (and Powder Magazine www.powdermag.com) and Ian for sharing.

RESCUING YOUR PARTNER(S):

Below is an overview of companion rescue response organized around the checklist steps from the AIARE Quick Reference: Avalanche Rescue located in the back of the AIARE field book. How the following tasks are organized and assigned will depend on the size of the group and the experience of its members. In small groups, only one or two people may need to carry out all the tasks in a suitable order. In larger groups, tasks can be undertaken simultaneously or in conjunction with other stages of the self rescue.

—CALL FOR HELP; DO NOT LEAVE SITE—

Do not leave site: YOUR actions are the victims' best and possibly only hope for survival. If you think you will lose cell or radio reception CALL FOR HELP NOW.

STOP-ASSESS SAFETY! ENSURE NO FURTHER HAZARD

- Risk of triggering a second avalanche
- Avalanche from above

The worst case scenario would be for an avalanche to take out a portion of your group, then in a hasty effort to rescue, the remainder of the group was caught in a secondary slide. Remember the universal rules of rescue:

1. Your own safety is your first priority.
2. Your second priority is the safety of the other rescuers.
3. Your third priority is rescuing the victims.

TAKE CHARGE or assign a leader

Avalanche rescue is no time for democracy. With a complex problem, invariably there are multiple solutions. The goal here isn't to debate each option at each step, but rather for the most competent leader to take charge, use a checklist to ensure the steps are carried out in the right manner, and get to business. If you're the leader, stay heads-up, try to avoid getting caught up in details or tasks and focus on managing the resources available by delegating specific tasks one step at a time, with excellent communication and a systematic approach to searching. If you're not the leader, do what you're told, and tell the leader when you are ready to take on another task. Everyone has the ability to call a "STOP" if safety is in question, but otherwise keep chatter to a minimum.

HEAD COUNT. How many missing?

Refer to the group list in your field book. Account for everyone and keep a record of who is where. Verbalize the number of missing people to everyone for confirmation.

CALL FOR HELP! (Cell phone, radio, emergency locator)

- Tell Name, Location, Nature of Emergency
- # of involvements, # missing, # known injured

Consider your position in the terrain, the scope of the task ahead. Often at this point you want to get a quick call out for outside help. Often cell or text coverage is available from high ridges, but may be lost only feet down the slope. If that's the case, call before changing your position. Mountain professionals and savvy backcountry travelers know the cell windows and dead spots for their terrain.

Once you contact an emergency dispatcher, don't allow them to keep you tied up on the phone. Give the critical details (above) and hang up. Leader or person with cell phone reception leave your cell phone turned on as dispatch will likely call back for additional details.

Avalanche TRANSCIVERS to "SEARCH MODE" (Physical check)

One of, if not the most common error in avalanche rescue is chasing the signal of another rescuer. Don't let it happen. If everyone in the rescue party switches to "Search" (receive mode) right away, this problem will be much less likely to

occur. Listen to your transceiver! If there is a close signal, (and you're sure you're not right next to the victim), then someone is still transmitting or "sending" a signal. Help them switch to Search, and get on with it.

Prior to entering the path, searchers turn off cell phones. The leader keeps phone on for a return call from dispatch.

❑ DETERMINE WHERE TO SEARCH

- Flow line below *POINT LAST SEEN*
- In line with clues
- Areas of debris, especially terrain traps

Do not search the entire avalanche path if you don't have to. Consider where victims might be in reference to where they were last seen. You want to reduce the size of the search area, but never assume something you do not know; the cost of failing to search an area is too high. Before you begin searching, make a mental note of landmarks in the path for orienting yourself later. Prior to entering the slide path searchers should turn their cell phones off.

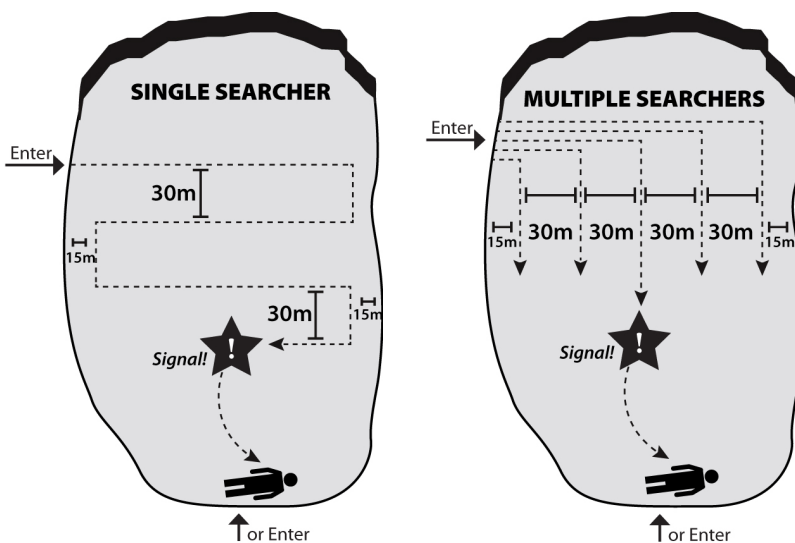
❑ SEARCH FOR SIGNAL & VISUAL CLUES


- Enter debris safely from side of path or toe of debris
- Determine escape route
- Spread searchers out in an effective pattern to scan debris
- Search strips max. 30m (approx. 30-40 strides)
- Search to edges of avalanche debris

This is the Signal Search Phase: searching for visual clues (skis, clothing, a hand/boot, likely burial location) and a transceiver signal.

Every avalanche accident scenario is different, so expect to modify your search pattern to suit the circumstance. Consider:

- The size and shape of the terrain
 - Further avalanche hazards
 - Other hazards such as slick bed-surfaces, cliffs, crevasses, cornices...
 - The number of victims
 - The number of searchers, their position in the path relative to the debris and their mode of travel
- Zig-zags, parallel lines or a combination can be used to build you search pattern. Ensure spacing between patterns is no greater than 30m.



Graphics courtesy of: 

❑ YELL TO OTHERS WHEN YOU FIND A CLUE OR RECEIVE A SIGNAL

- Pull clue out of snow and leave on snow surface

Avalanche rescue involves a great deal of puzzle solving. Give everyone, especially the rescue leader the chance to work with all the known details. Yell out what you've found so the leaders can place a clue in the terrain to triage and manage the scene. Pick up every glove, ski, pole etc..., you never know if there might be someone attached. Leave everything right where you found it. Clues help show a victim's trajectory.

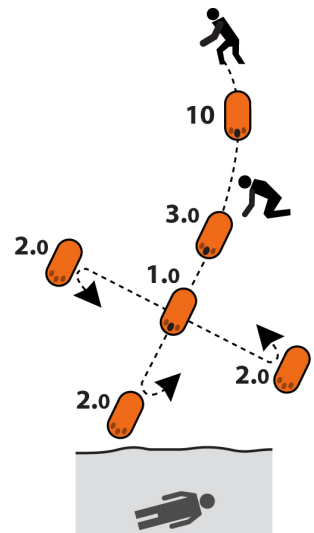
Two common mistakes are missing visual clues and a search pattern that leaves gaps in coverage. Throughout the search, keep your eyes up, look for visual clues and keep your search pattern regular and systematic. Use references like trees, rocks or terrain features to help keep yourself oriented.

❑ FOLLOW TRANSCIEVER SIGNAL TO TARGET AREA

- When possible two searchers work together
- *SLOW AND PRECISE* within 10m!
- Place transceiver near snow surface on final approach
- 2nd searcher assembles probe and shovel

The Coarse Search Phase begins once a strong signal is acquired: rescuers abandon their signal search pattern to follow a transceiver signal to the burial area.

With the improvements in transceiver technology over the last decade, following a signal to the burial site has become more intuitive. That said, the process can still be confusing, especially if you move too fast, or in a non-systematic fashion. Keep the center arrow lit, and make sure the numbers are decreasing. When you get to a distance reading of 10 get your beacon close to the snow surface. Doing so will force you to slow down, and improve the accuracy of your final trajectory. If there is only one victim, once the signal has been found, other searchers can get ready to help with a probe and shovel. If there is more than one victim, other searchers should remain in their search patterns, looking for victims within their search strips (distance readings smaller than the search strip width).



❑ TARGET BURIAL SITE WITH TRANSCIEVER & PROBE

- 2nd searcher *PROBES THE LIKELY BURIAL AREA* in front of the searcher's trajectory when the transceiver signals 3 meters
- To target using the transceiver, *BRACKET and MARK* where the signal fades ahead, behind, and to the sides of the target area
- At the center of the transceiver searcher's mark *PINPOINT USING THE PROBE*; use circular pattern from the center of the target outwards
- Probe Strike = Burial Location. *DO NOT REMOVE PROBE!*

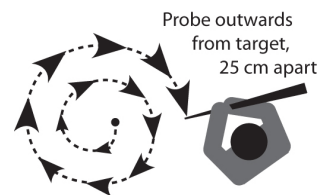
The Fine Search Phase involves bracketing with a beacon in the immediate vicinity of the buried victim. At 3m distance, the directional capability of the transceiver is lost. Look back at your approach, determine your trajectory and carry that direction forward in a straight line (mark with a ski pole if you find this helps). Make sure the beacon is on the surface and slowly work forward along a straight line ignoring any directional arrows.

As the signal fades in each direction encircling the target area, forward, back, and to each side, mark with a glove or line in the snow the point where the signal fades. This is called "bracketing." Remember to maintain the orientation of the

beacon flat and forward during the bracketing. Do not rotate it side to side or tip it up and down. Look for the strongest signal (smallest distance reading) to indicate the searcher is closest to the burial.

If a second rescuer is able to help, have them probe along the trajectory in front of your 3m trajectory marker. Work together so that the prober and the transceiver searchers don't get in each other's way. This technique takes coordination and practice, but often results in a victim being probed much quicker than a single person can do alone.

Once the transceiver searcher locates the strongest signal (smallest distance reading), again mark the location. You don't want to lose this carefully gathered information. You now have a line (your first marker) pointing towards a point (your second marker). Probe around the strongest signal in a spiral or concentric circles, with each probe strike approximately 1 foot (25cm) apart. When you get a strike, leave the probe in place. Do not begin shoveling until a probe strikes the victim. If you have additional rescuers available, another probe strike can help to show the victim's orientation on the slope, which may reduce digging time and effort with deep burials.



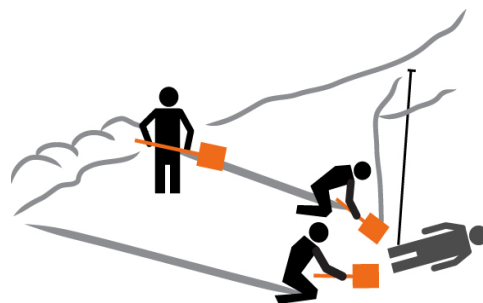
❑ SHOVEL FAST & EFFICIENTLY

- Consider burial depth and therefore the size of the hole
- Start with a large step downhill and away from the probe
- Dig toward probe; throw snow far away!
- SHOVEL IN TEAMS (if rescuers are available)
- Careful shoveling as you reach your buried companion

It's true, when it comes to digging in avalanche debris Bruce Edgerly is right: "strength and motivation trump technique every time." A good backcountry partner is fit enough to maintain a hard shoveling effort. But, all things being equal (say one shoveler racing against the clock) efficient shoveling technique will shave minutes off what is often the longest and most strenuous component of companion rescue - excavating a victim.

Keep the following tips in mind:

- Step away, downhill of the probe to get off the victim. If you stand above the victim, you may crush any air space.
- Delineate the area you plan to shovel with a few quick scoops to help keep you shoveling where you planned to, not accidentally drifting to one side or another. You'll need an area at least a body length wide for an average burial depth.
- Dig into the slope, not straight down. It's much more efficient to throw snow out from the slope, as opposed to lifting it up out of a hole. To not block your throwing lane directly behind you, begin by throwing snow to the sides, then later throw snow downslope as you develop a deeper trench.
- Work in teams when possible. If you have to dig solo, pace yourself at the highest shoveling rate you can sustain for many minutes. If you've got more than 2 people, go as fast and hard as possible, then rotate out and let someone else give it their all. Rotate any time someone slows below a maximum shoveling effort (usually 30-60 seconds).
- Refine your shoveling as you near the victim. Try to dig towards the victims head and chest, and attempt to not injure the victim with your shovel blade.
- As you get the victims face and chest exposed, plan how you will carefully move the victim onto the ramp you dug. Cold victims require careful handling. Now is a great time to place an insulating pad where you plan to move the victim.



❑ PATIENT CARE

- Keep dry/warm (insulate from snow); manage injuries
- Move to safe terrain; consider options for evacuation
- Communicate victim's condition to arriving rescuers

First Aid is beyond the scope of this course and manual, but keep in mind the basic ABC's. Open an Airway first. This may involve removing snow from a victim's mouth. Help them Breathe next. Their chest may be compressed under the weight of snow, so efforts to get them breathing require rescuers to excavate their torso so the chest has room to expand. Rescue breaths may be necessary. Manage Circulatory issues as a third priority. We'll defer to your First Aid training at this point.

Now you have a victim in a potentially hazardous place, in a hole in the snow, at the bottom of an avalanche path. Consider moving yourself and the victim to a safer location. Keep the patient dry and warm. Get them off the snow. All the clothes piled on top of a victim will do no good if the snow is robbing them of their precious body heat from below.

Treat injuries to the best of your ability. Consider the mechanism of injury here can be quite violent, so manage potential spine injuries according to your level of medical training. Loosen a victims boots, but do not remove them as any lower leg injuries may swell and make getting boots back on impossible.

Plan for your next series of events. Can you communicate with outside rescuers? Can they get to your position before nightfall? Are you able to get yourself out? Is it best to stay put and wait? Where can you get shelter?

☐ IF A HELICOPTER COMES TO YOUR AID

- Secure loose items so they do not blow away
- Wait for rescuer to come to you

Today, helicopters are a realistic rescue support tool in many areas. It's wise to know some basic helicopter safety.

Before a helicopter arrives, position yourself downhill and ideally up wind of a landing zone (LZ). The helicopter will land into the wind (12 o'clock), and should be approached from the front sides (1-3 o'clock or 9-11 o'clock). The LZ should be open, clear of trees or other obstructions for at least 100'x100' (30m x 30m) across. Within this area, make sure no items could get caught up in the rotor wash (e.g. loose clothing, straps, sticks etc.). Secure a short stick with a streamer upwind of where the helicopter will land to show the pilot where the winds is blowing from. They will probably want to bring the nose of the heli towards the stick, with the streamer blowing towards them. Place your gear in a pile and use your body to hold the items down if you're within the LZ area.



Once the helicopter lands, hold your position, make eye contact with the pilot and wait for instructions. Never approach a helicopter from uphill or from behind the aircraft. In many cases the pilot will shut down the heli and approach you. Be patient, this process may take several minutes.

— STAY CALM —

Avalanche rescue is inherently stressful. Don't be rash, think through your actions before commencing. Use the AIARE Avalanche Rescue Quick Reference to help guide your actions so you don't forget critical steps. In high stress circumstances, everyone can benefit from a checklist to stay on track. Would you want your surgeon to use a checklist to make sure they stay exactly on task? Research suggests surgeons often think they don't need one, but when asked if they were the patient would they want their surgeon to have one, almost all said yes.

REALITY CHECK: THE IMPORTANCE OF PRACTICE

Imagine the gut-wrenching emotions of helplessly watching an avalanche engulf a loved one, rag dolling over a convex roll, out of sight.... It's a gruesome worst-case scenario, but one where in order to offer the best possible chance of a good outcome, we've got to stop, think and step into action decisively, without making another mistake.

We've all heard it: "Perfect practice makes perfect performance." Pre-event rehearsal is a proven strategy to reduce stress and improve competence in completing critical life-saving actions in sequence. Beyond just practicing, it's how you practice that will improve your skills:

- Set up your practice area in a realistic scenario (e.g. not a parking lot or flat snow slope, but an area with varied terrain and deep snow, but safe from avalanches).
- Plan your actions. Verbalize what you will do before doing it.
- Practice communicating clearly and efficiently.
- Identify errors, and repeat the tasks correctly, immediately.
- Review your practice to identify how you can improve next time

Like a driver's seatbelt, having partners well-practiced in companion rescue may not change the outcome of a worst case scenario, but it may make enough difference to save a life in many accidents. Given the opportunity to wear a seatbelt, or to choose whom you travel with in the backcountry, why not give yourself and your partners the best chance of surviving.

6.2 – Avalanche Rescue and Safety Equipment

Trained partners are a key component of an avalanche rescue system, but so too is the right equipment. Following is an overview of the primary equipment options today.

TRANSCIVER, PROBE, SHOVEL AND PARTNER SYSTEM

Currently the most effective system for reducing burial time is an avalanche transceiver, collapsible probe, shovel and trained partner. Other tools people have used (avalanche cords, balloons, dogs, etc.) are far less effective.

Transceivers have been around since 1968 and have a significant history. Most backcountry travelers are familiar with this equipment. Since the development of this technology, the mortality rate has decreased from 76% to 66%. Mean recovery time has decreased from 120 minutes to 35 minutes. The mortality rate is still relatively high due to the skill required for effective search, pinpoint, and recovery. Practice is essential both with the transceiver and with probe and shovel.

Multiple antenna avalanche transceivers are the most commonly used "beacons" used today. Once turned on, the units automatically go into a "transmit" mode continuously sending a radio signal, until they are switched into a "search" mode. At any given point in time, only a single antenna is transmitting the signal. When searching, multiple antennae units are able to electronically compare the signal strength across two or more antennas, to offer directional guidance towards a transmitting antenna. AIARE recommends multiple antennae transceivers for all travelers in snow-covered backcountry avalanche terrain.

Probes remain a critical component in this system by helping to reduce search times with exact confirmation of a victims position within avalanche debris. Pinpointing with a probe costs very little time and offers the security of knowing that you're about to dig in the correct location.

One tool that may add additional benefit with this rescue system is an Avalung. The Avalung is designed to help a fully buried victim maintain an airway beneath the snow, to reduce the effects of "ice masking," and to slow the accumulation of carbon dioxide in a buried victim's breathing space. The Avalung uses a one-way valve with a filter that enables the victim to inhale available oxygen from the snow while exhaling carbon dioxide, distributing it to the rear of the buried victim. These may be integrated into backpacks, or worn separately over one's clothes in a chest harness.

RECCO® Technology

RECCO is an additional tool to make oneself searchable to more than 800 professional (aka organized) rescue teams around the world. The RECCO reflector is a passive transponder that reflects back the directional RECCO signal to a RECCO detector used by professional-level rescue teams. These reflectors require no maintenance and come integrated into some of the gear (winter clothing, boots, helmets, etc.) you buy. Electronic search means are the best ways to be found quickly. Your transceiver makes you searchable to your companions. The RECCO reflector makes you searchable to professionals. The reflector is not a substitute for an avalanche transceiver, probe and shovel. When someone is buried it is the combination of the transceiver and reflector that give buried victims the best opportunity to be found faster whether in a ski area or far in the backcountry.

AVALANCHE BALLOON PACKS

According to Swiss statistics from accidents between 1981 and 1998, the most effective means of preventing fatality in an avalanche accident is to avoid complete burial. This study shows that the **overall buried victim mortality rate is 52%**, but the **partly buried victim mortality rate is only 4.2%. DON'T GET BURIED!**

Avalanche balloon packs are designed to prevent or decrease burial depth. Most are integrated into a backpack, some are integrated into a stand-alone vest (not compatible with a pack). Each year, avalanche balloon packs gain more traction within the avalanche industry, used by more and more operations and individuals, with more options to purchase in the marketplace.

Each design has its own specific design parameters, but all attempt to increase the victim's surface area, effectively making the wearer larger. Larger, less dense objects tend to "float" or rise to the top much as the larger nuts surface as you shake a can of mixed nuts. Avalanche balloon packs have a canister of pressurized air or nitrogen gas that rapidly fills multiple or single balloons that are attached to the sides, front or top of the pack. The balloon(s) is deployed with an accessible shoulder strap ripcord that triggers inflation from the cartridge. Including deployment errors and gear failures, the avalanche balloon pack has been shown to reduce burial likelihood and reduce mortality rates from 23% to 2.5%.

A secondary, but potentially no less important factor is that avalanche balloon packs may reduce the chance of trauma. Depending upon the location of the inflated avalanche balloon pack (back, head/neck, or chest) certain types of impacts may be lessened. A helmet and potentially body armor may work with an avalanche balloon pack to further reduce trauma.

An important consideration, is that an avalanche balloon pack is not guaranteed to prevent burial, so a transceiver, probe, shovel and partner are still considered essential equipment regardless of whether an avalanche balloon pack is used.

PRESENTATION NOTES: