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2024 Winter Mountaineering & Advanced Crevasse Rescue

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Course Schedule

Date*+	Field / Experience Trip	Req/Optional
Feb 8	WMCR Course Kickoff	Optional
Feb 13 & 15 / Feb 12 & 13	FT #1 - Belaying/Lowering/Ascending	Optional
Feb 27 & 28 & 29 / Feb 23 & Mar 5	FT #2 - Equalizing Anchors and Mechanical Advantages	Required
Mar 12 & 13 & 14 / Mar 6 & 12	FT #3 - Rope Setup + Full Rescue Practice	Required
Mar 30 & 31 / Mar 17 & Mar 23	FT #4 - Small Party Rescue	Required
Apr 13-14 & Apr 20-21 / Mar 30-31 & Apr 6-7	ET #1 - Rescue + Emergency Preparedness	Required
May 10-12 & May 25-27 / May 17-19 & Jun 7-9	ET #2 - Glacier Travel & Mentorship	Required

* if more than 1 date/session scheduled, students attend 1 only

+ dates divided with '/', are delineated as 'mixed cohort dates / women's cohort dates'

Skills Nights

Scheduled on Fridays after each FT, starting at 6 pm. (Location: Seattle Program Center, exact space will be in the messages)

- Feb 16 (after FT1; ideally for topics covered at FT1)
- Mar 1 & Mar 8 (after FT2; ideally for topics covered at FT2)
- Mar 15 & Mar 22 (after FT3; ideally for topics covered at FT3)
- Apr 5 & Apr 12 (after FT4; ideally for topics covered at FT4)

Field Trip Leaders will notify the students and course leader (KD) of who needs more practice and the participation for these skills nights will be limited to only these, unfortunately due to lack of instructors' availability.

The message is sent the night before (Thursday evening) to those who need to practice.

In case the Field Trip is scheduled on Thursday, they (those who need to practice) shall be prepared to join on Friday if they can and look for the message with details on Friday morning.

Introduction

Welcome to the Winter Mountaineering and Advanced Crevasse Rescue module of the Intermediate Alpine Climbing program. The course is a combination of classroom, online, and field instruction to equip you with the skills and experience required to safely plan and execute winter glaciated mountaineering trips. Participants will gain proficiency in safe traveling techniques on steep and glaciated terrain, systems for 2-person travel, trip planning, and the execution of rescues. The course goes beyond basic crevasse rescue and covers a variety of scenarios, including solo crevasse rescue. Once you graduate, you are eligible to become a rope leader on glacier climbs for the Mountaineers.

Cancelation Policy

Participation in the course can be canceled for a full refund minus a \$50 cancellation until a January 7th. See the [Mountaineers Cancellation and Refund Policy](#).

Participation Criteria

In order to participate in the course, the following criteria should be met:

1. Have membership in The Mountaineers
2. Basic technical skills and AIARE Level 1 training
 - a. Completion of the Basic Alpine Climbing Course, Basic Glacier Travel Course, or an equivalent qualification.
 - b. Wilderness First Aid certification or an equivalent medical training.
 - c. Proficiency in Wilderness Navigation or an equivalent course.
 - d. Completion of AIARE Level 1 avalanche training (must be finished prior to the Winter Mountaineering Experience Trip, but not necessarily at the time of application).
3. Previous scrambling and climbing experience
 - a. At least 3 basic glacier climbs and preferably at least 2 winter scrambles/snowshoeing/backcountry skiing
4. Fitness

- a. Ability to hike Mount Si to the bottom of the haystack in under 2 hours or Mailbox Peak in under 2.5 hours with a 35 lbs pack (30 lbs for people weighing less than 130 lbs) in the Aerobic Zone.
5. Commitment to volunteerism
 - a. 24+ hours of volunteering commitment in the past year at Mountaineers' or outside
 - b. Ability to help with the Basic Climbing Courses at glacier/snow-related field trips and with Navigation Courses at in-person workshops & field trips during the course year at a minimum.

Level 1 Avalanche Training

Level 1 Avalanche Training certified by the American Institute for Avalanche Research and Education (AIARE) is required for all snow related activities. This training is done independent from the Winter Mountaineering & Advanced Crevasse Rescue course. AIARE-certified training is offered at least once per year by the Seattle Mountaineers. Students may take their AIARE-certified training from other organizations as well. AIARE Level I equivalent certification such as from the Canadian Avalanche Association (CAA) or National Ski Patrol (NSP) is accepted. AIARE Level 1 is required for all snow and ice related modules within the Intermediate climbing program and must be completed before the first Winter Mountaineering Experience Trip of this course.

Graduation Requirements

In order to graduate with the Winter Mountaineering & Advance Crevasse Rescue badge, students must complete all online learning modules, attend all field trips, and display competency at experience trips.

Graduation Checklist

- FT #2 - Equalizing Anchors and Mechanical Advantages
- FT #3 - Rope Setup + Full Rescue Practice
- FT #4 - Small Party Rescue
- AIARE 1
- ET #1 - Rescue + Emergency Preparedness
- ET #2 - Glacier Travel & Mentorship
- Fitness evaluation
- Prusiking skill check
- Volunteer Day

Rope Leaders on Basic Climbs

Course graduates earn the [Glacier Climb Rope Leader](#) badge, qualifying them to participate as rope leads on Basic Glacier Climbs. Glacier rope leads are expected to:

- Demonstrate technical competence, interpersonal skills and good judgement.
- Show up prepared as if they were leading the climb. This includes having all the gear needed for the climb, detailed knowledge of the climbing route as well as the descent, ability to navigate on and off trail, knowledge of potential hazards and how to mitigate them, and more.
- Be courteous, patient and humble and generally display good expedition behavior.
- Assist the climb leader in organizing and managing the climbing party, route finding, setting up rappels, accounting for whereabouts of students, resolving conflicts, etc.
- Understand the [Climbing Activity Standards](#).

Course Curriculum

This course will be taught through 5 *mindsets* you may assume throughout your mountaineering adventures: traveling techniques to protect your followers, solo crevasse rescue, small party rescue, benighted, rope lead mentorship. By placing skills within a mindset, the appropriate response should become apparent when you find yourself entering a mindset.

Mindset 1: Traveling techniques to protect your followers

- Snow anchors
- Steep snow pitching considerations
- Modern methods of belaying and lowering
- Escaping the belay

Mindset 2: Solo Crevasse Rescue - Addressing multitude of crevasse rescue scenarios as the only rescuer.

- 2-person travel
 - Rope setup
 - Traveling techniques
 - Solo crevasse rescue
- Advanced crevasse rescue
 - Higher mechanical advantages and efficiencies (5:1, 6:1, and 7:1, optionally 9:1) for hauling/raising systems than taught in the Basic curriculum (2:1 or 3:1)
 - Equalizing anchors

- Attending an unconscious climber (rappelling and ascending the rope)

Mindset 3: Small Party Rescue - Moving the fallen or injured climber away from technical terrain to point of care with one rope team (2-4 individuals) available to assist in rescue.

- Scene Size-up
- Making and executing a plan
- Releasable hitches
- Converting raising to lowering and lowering to raising
- Passing knots
- Administering aid
- Transporting an injured climber on glacier or gentle terrain

Mindset 4: Benighted - Handling an unplanned overnight

- Emergency Shelters
- Second day traveling plans in consideration to avalanche terrain in absence of knowledge on weather and avalanche forecast.

Mindset 5: Rope Lead Mentorship

- Leading a rope team on glacier climb
- Finding and navigating crevasses
- Techniques for rope management and moving efficiently
- Working with basic students and peers

Course Structure

The course consists of four methods of education: online self-paced learning modules, skills nights, field trips, experience trips, and a day of volunteering with another course.

Online self-paced learning modules

We will be using the co-assemble platform to track your at-home learning before our in-person meetings, so we again have a common background established to either come with questions and see the new skills unfold or have a medium to come back to and refresh your knowledge to possibly get a bigger picture understanding of the same.

There are 4 main learning modules:

- Course Outline & Gear Needs (due before course kickoff)
- Glacier Travel Considerations (due ~10 days before ET#1)
- Planning and Leadership (due ~10 days before ET#1)
- Rescue Systems (use as reference)

Skills Nights

These activities are informal hangouts where you may join us to practice the skills you need to work on the most. They will be periodically posted on Thursday nights.

Some of you may be recommended to come to these sessions so we all get to meet the minimum standards of the course to graduate. We highly encourage our students to either be able to practice by themselves or come to these Skills Nights to let your progress be known to course leads.

Field Trips

These activities are held at Seattle Program Center to learn technical skills. These field trips will happen on any day, whether it is rainy, snowy, sunny, or windy. We will make accommodations to take care of one's well-being. If for some reason this is not feasible, we will work together to align our schedules and make it work for you. Your flexibility is appreciated here.

- FT 1: (Optional to those who took Int. Rock Modules) Top site belays and lowering, rappel to ascension conversion.
- FT 2: Equalizing anchors and mechanical advantages.
- FT 3: Rope set up for 2, 3, and 4-person rope teams, full crevasse rescue practice on unconscious fallen climber
- FT 4: Small Party Rescue - Escaping the system, rescuer setup with patient care, and moving injured climber over technical terrain.

Experience Trips (ETs)

Experience Trips are activities in which you actually get to go out and play in the snow/glacier. There are two variations for these experience trips, and each has its own objectives. Having said that, both are planned as overnight trips.

- ET1 - Rescue + Emergency Preparedness: Rescue practice in real crevasse hopefully, building emergency shelters, winter camping, winter gear use, trip planning execution with emergency preparedness
- ET2 - Glacier Travel & Mentorship: Navigating crevasses, traveling on steep slopes, and mentorship to navigate and plan for a destination (Sherman Peak)

Volunteer Day

Volunteers are the heart and soul of our community at The Mountaineers. Part of this course is preparing you to be a leader for The Mountaineers. One way to start exhibiting this is through volunteering with courses you have graduated from, such as the Basic Alpine Climbing or Navigation course. You should sign up to volunteer at a Basic Alpine Climbing Course field trip or share which other course you are currently volunteering with.

Gear Needs

Required Gear

Harness

Features shall include:

- The double-back light buckle and fastening strap are easy to operate—even with gloves—and make this harness comfortable to wear when walking or suspended
- Adjustable leg loops
- 2 Gear Loops
- A single tie-in point
- Retainers on each leg loop to let you carry an ice screw

Winter travels do include steep snow pitches and during the course, our students spend about 40-50 mins hanging on the rope while the other students practice rescue on the roof. Please choose the practice wisely.

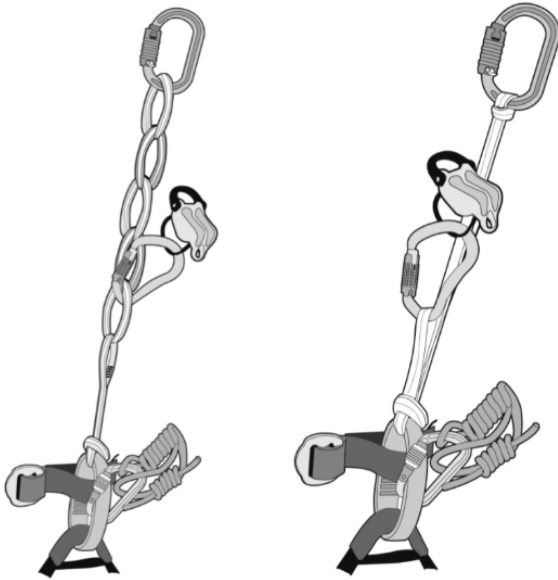
Helmet

Features shall include:

- low profile, ventilated helmet
- UIAA standard protection
- If touring, it shall be suited for ski touring
- Front of helmet designed for integration of ski goggles
- Rear elastic is compatible with ski goggle headbands
- headband can be adjusted easily, even with gloves on

Rappel Extension Alternatives

Rappel extensions can be made out of a sling; avoid carrying PAS (gear that has single use) on climbs.



Belay Device

The best belay device is an ATC with a guide mode function that has a large hole for using it in an assisted brake mode and a smaller hole on the other side of the tube to assist in rescue for loaded strands.



Carabiners

We recommend carrying 5-6 locking carabiners and enough non-locking carabiners to organize your gear as needed. When lacking a pulley, it is important to consider a round stock carabiner when rigging a hauling system, I-beam stock has the least efficiency.

Chest Harness & Texas Prusiks (not required)

We recommend leaving chest harnesses and texas prusiks at home and improvising to work with slings which are multi-use materials that we already carry up the mountain.

Cordelette

Two cordelette made from ~6 meters each of 6 mm nylon cord or 5mm tech cord.



This can be used for following situations:

- Extending the anchor/Equalizing the second anchor
- Block and tackle releases on loaded ropes
- Create releasable Munter Mule Overhand
- More in other rock/rescue modules

Pulley

Please consider reading the technical manual of your pulley and note the efficiency of the same. Some pulleys are meant to be about 90% efficient while others can be pretty low.

Prusik

Two prusiks made of 6 mm nylon cord or 5mm tech cord long chord tied with double fisherman knot for 6mm or triple fisherman knot for 5mm chord.

Slings/Runners

A mix of shoulder length and 120cm long slings and having a variety of materials to use from is beneficial.

Ice Axe

A regular ice axe, rated for basic glacier travel.

Crampons

A regular 10-point crampon would suffice. Although some winter mountaineering trips include steep snow travel which could use the front point crampons when snow is found to be hard and icy.

Picket

Features shall include:

- ~22 inches long
- V-shaped preferred but others work as well
- Stainless steel strike plate, if beneficial to have
- If Cable runner, having a removable cable is worth the investment and must be rated to ~10kN

Recommended Gear

Petzl Micro/Nano traxion & Tibloc

These devices ease the use of adding a friction hitch on a loaded strand. Tibloc gets locked to move the rope in one direction and micro traxion acts as a pulley on top of creating a progress capture for your hauls.



These devices do bite into the rope, so it is important to ensure it doesn't do that on the same section of the rope over and over again.

Tool with hammer

Adze vs. Hammer:

Mountaineering axes always have an adze, which has many uses, like step cutting, digging snow anchors, chopping a tent platform, or digging a snow cave. This flat, shovel-like feature also provides a great grip platform during self arrest.



When climbing technical ice or mixed routes, however, the need for an adze is much lower. Instead, many ice tools feature a hammer which can be used to pound in pitons. Many climbers choose to have one adze tool and one hammer tool, but you can have any setup you want. Since most ice tools have modular heads, you can switch out adzes and hammers as necessary, or even remove them completely to cut down on weight. In late season or high altitude climbing, hammer is often found useful to drive the picket into the glacier.

Ice Screw

A 22cm long screw is very beneficial for glacier climbs. It is often needed to protect yourself and perform crevasse rescue.

Field Trip Content

Field Trip 1

Mindset

Protecting your followers on glacier or winter mountaineering trips

Course Leader Thoughts

- This FT is optional for those who have taken Single/Multi-Pitch Trad or Self Rescue Courses.
- Prusik belaying and other means taught in the basic climbing courses such as carabiner-axe belay, and hip belay work on glaciated terrain with gentler slopes and either require the belayer to be ready to self-arrest or have themselves anchored.
 - Using Ice-Axe as an anchor placed vertically into the firm lacks protection for falls due to the leverage of the sling that is hitched in the eye at the top of the shaft.
 - Pickets make a good anchor (more on this at Experience Trips)
- For steep terrain often encountered in winter mountaineering or ice climbing trips, prusik belays and carabiner-axe belays are incompetent to hold the slip/fall.
 - Hip belays or belaying from a harness using a belay device on less steep terrain works best (more on this at Experience Trip #1)
 - Rock Climbing Trip Style belaying from the top works best if the terrain is steep where the device can be isolated from the snow surface.
- Skills to be taught:
 - Anchor building (bolts used for practice can be ice screws or pickets)
 - Belaying and lowering techniques
 - Escaping the belay

Skills Covered

1. Anchor Building with EARNEST principles:

Equalized

Angle (less than 90, about 45-60 ideally)

Redundant

No Extension (actually minimize extension to what is okay for a given situation)

Strong (discuss the strength, redundancy is at times not required for example slings when connected to the anchor or a well-rooted tree that is >12 inches wide or a boulder that is wedged in and doesn't vibrate on hits)

Timely

Anchor Types:

- a. Two point
 - (i) Powerpoint; (ii) Quad; (iii) Sliding-X with limiting knots

- b. Single point
 - (i) Tree ; (ii) Large boulder ; (iii) Single T-slot picket

Reference Material: Rob Busack's Youtube Video ([▶ A Primer on Climbing Anchors](#))

2. Munter Hitch

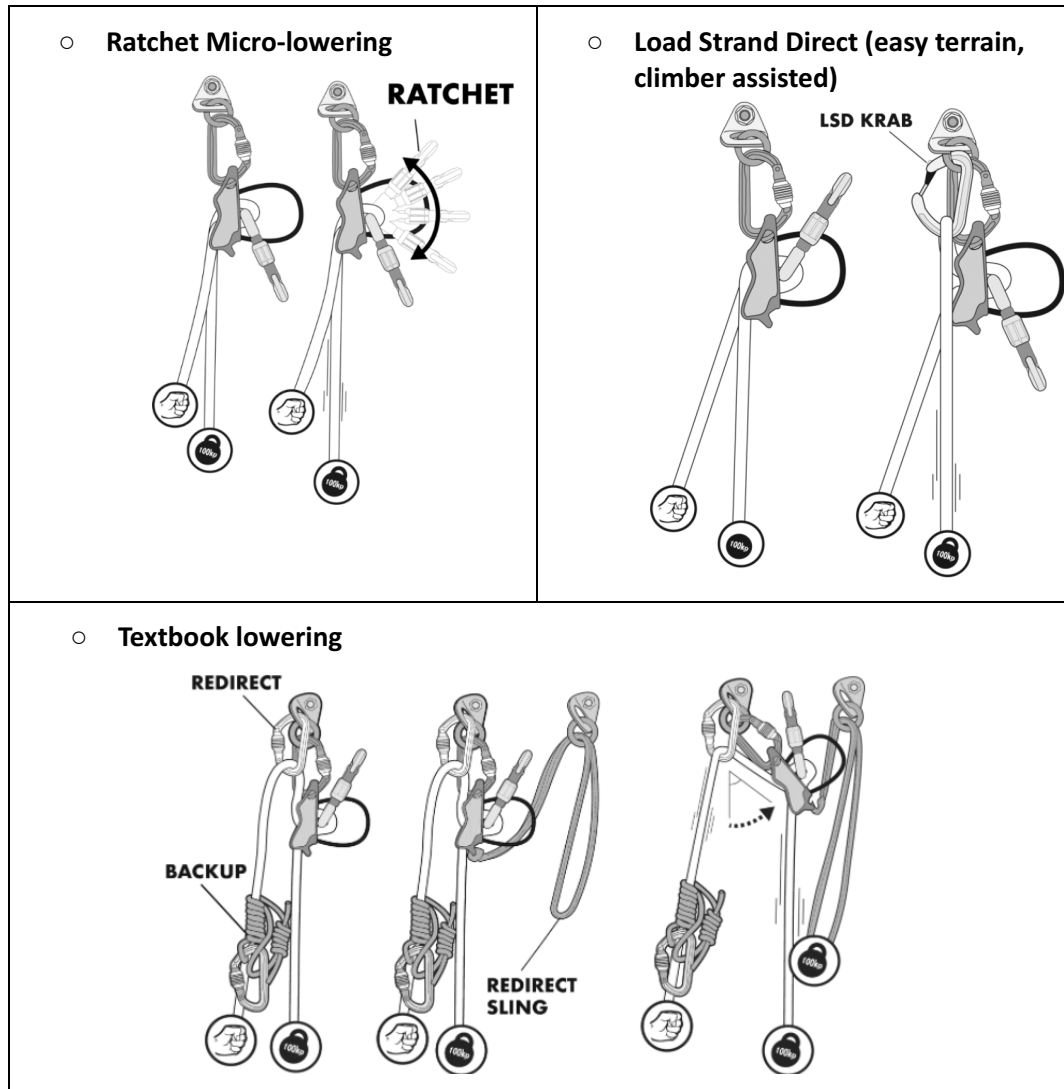
- a. Belaying and Lowering (always use third hand)

3. Belay device in guide mode

- a. Belaying and Lowering when belaying using a device in guide mode
 - i. Ratcheting
 - ii. Load Strand Direct
 - iii. Textbook lowering

Reference Material:

- Youtube Videos:
 - [▶ Transitions: Belaying From the Top](#)
 - [▶ Lowering from the top](#)
- Sketches



4. Escaping the belay

Scenario: Belay attached to anchor using a sling and is belaying their follower who needs rescuing) using a belay device on their harness.



Reference Material:

California Climbing School's Youtube Video ([How to do a Belay Escape](#)).

Note the following on the video:

1. There is a lot of rope available to escape. When not available the students should know how to use the cordelette to escape.

Field Trip 2

Mindset

Crevasse Rescue Nuances

Course Leader Thoughts

- In Basic, students are introduced to either a drop loop (2:1) or Z-pulley (3:1) rescue systems but have a minimal understanding of...
 - equalizing anchors or
 - pros/cons of these hauling systems or
 - how do address an unconscious climber or
 - how to improve the hauling system when not having enough resources, i.e. rope length or humans when either a middle climber needs rescuing or the rescue rope isn't enough due to a stretch of up to 30% due to the fall or when encountering the rescue situation with no team around them for help/assistance.
- Skills covered with an understanding that we focus on above-mentioned components of crevasse rescue:

- Equalizing Anchors.
- Converting 2:1 to 6:1 and 3:1 to 6:1
- Converting from Rappel to Ascension (this skill practice can be skipped by those who took Self Rescue courses)

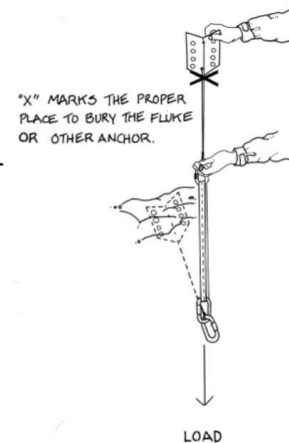
Skills Covered

1. Equalizing Anchors

a. Backing up

This method involves simply connecting a second anchor to the carabiner of the first one. The connection should have essentially no slack, so that if the first anchor fails or shifts, the weight transfers to the second anchor immediately without generating a shock load.

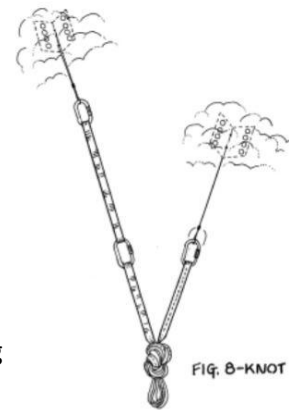
This simple system is fine for linking two flukes or two vertical picket placements or when building a backup anchor before loading the primary anchor by equalizing the anchors.



b. Equalizing

Distributing a load between a pair of anchors can more than double the reliability of the overall anchor. Although webbing works fine, this is a good place to use a cordelette.

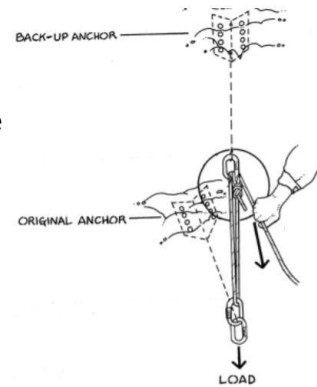
- Clip a cordelette into both anchors.
- Gather both strands of the cord and pull them directly toward the anticipated load, forming a bight.
- Tie this bight into an overhand or figure-eight knot. Now you can clip the load to the resulting loop.
- If the bight and knot are rigged properly, both anchors share the force equally. What makes this method safer is that if one of the anchors fails, that share of the load comes onto the other anchor immediately, preventing a shock loading.
- One concern with this system is that if the load changes direction most of the force shifts onto one anchor. But with most rescue loads you should be able to accurately predict the load's direction.



c. Tensioned backup (Block and Tackle, tied off with Mule+Overhand)

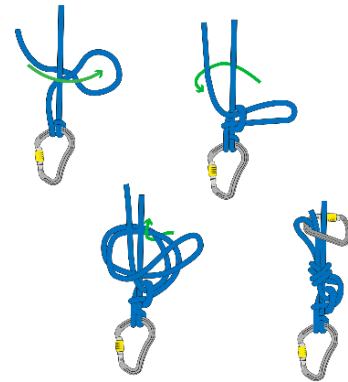
When a primary anchor is already loaded, you can connect the backup with tension so that it shares the load.

- Set a backup anchor "behind and/or away" from the first.
- Run a cord from the carabiner of the backup through a new carabiner on the primary and back toward the backup.
- Pull hard on this runner creating tension between the backup and the load on the primary. Then clip it into the backup's carabiner.
- Repeat the laps between carabiners as needed.
- While maintaining the tension, tie off the runner, the same as for tying off a belay.
- This is an excellent method (also known as block and tackle) to reinforce an anchor for hauling, and for linking one equalized pair with a second equalized pair.



d. Tensioned backup (Munter, tied off with Mule+Overhand)

- This technique is taught in the basics to be hands-free when belaying someone and when the climber needs to rest or in case of an emergency to call for help.
- Whether you tie off a belay device or a Munter hitch, a mule-overhand is a great tool to tie off anything and everything, such as our tensioning backup system.

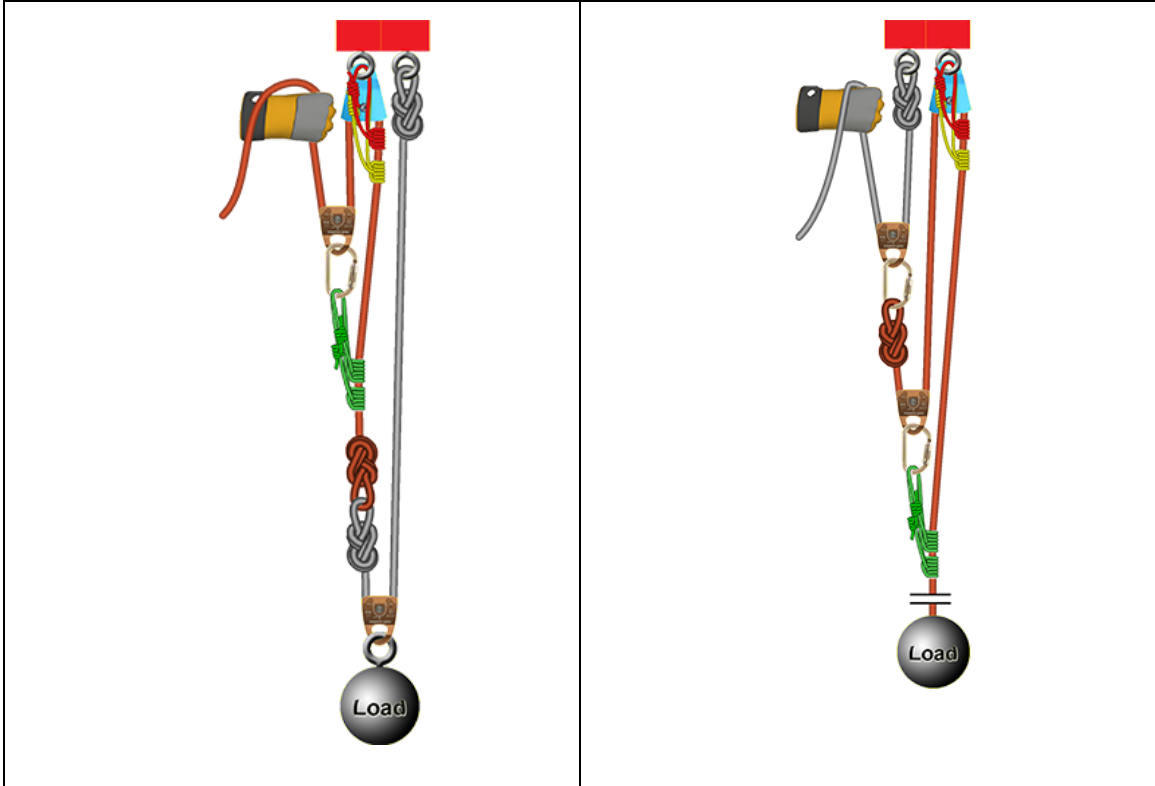


Reference Material: AMGA Youtube Video

([How to Back Up a Snow Anchor for Crevasse Rescue](#))

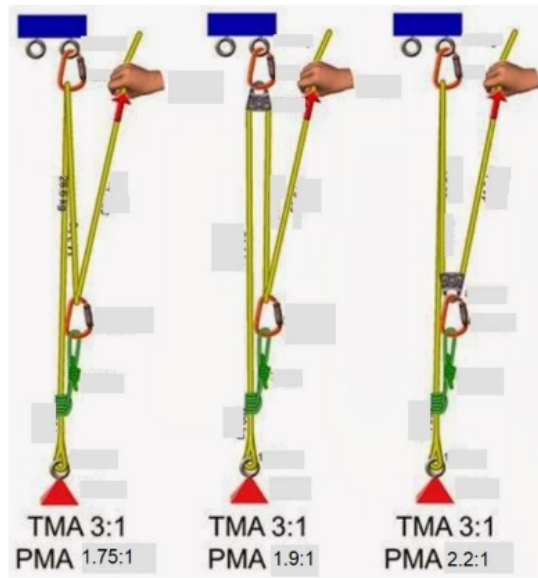
2. Converting to Higher Mechanical Advantage

<p>Converting 2:1 to 6:1 - <i>Start with a drop loop when the strand connected to the fallen climber is entrenched and you can have enough rope to do a loop back to the anchor.</i></p>	<p>Converting 3:1 to 6:1 - <i>When the rescue rope isn't enough to return to the anchor (at least over the lip), then start with the other end of the rope or new rope which allows us to start with 3:1 over a prepared lip.</i></p>
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Pulley Efficiency -

- Carabiners are assumed to have 50% efficient and pulleys at 80% for the numbers stated below the sketch. If we use two pulleys (one at anchor and one at friction hitch, the advantage becomes 2.44:1).
- Rounded carabiners perform better than I-beam stock carabiners
- Some pulleys are at 90% efficiency while others are 70%



Rule of 18 -

- There is something called the "Rule of 18" that we must adhere to. It's a guide limiting the number of rescuers used to pull on a haul system.
- Here's how it works. Let's take a 6:1 MAS (mechanical advantage system). We'll take the number of rescuers used and multiply that number by the first number in the MAS 6:1. If we have two rescuers we would multiply 6×2 which equals 12. Twelve is under 18 so we are good. If one or more rescuers were added to the team, we would meet or exceed our rule of 18 ($6 \times 3 = 18$ or $6 \times 4 = 24$).
- Here is an example of why we conform to the "Rule Of 18." Your rescue team is performing the rescue of a victim located at the bottom of an overhung crevasse. You've rigged all the necessary rigging, secured a bombproof overhead anchor, and assembled five of your strongest rescuers to perform the raising operation. The MAS you chose to use was a prepackaged 6:1 and the victim weighs approximately 250 pounds. The 6:1 MAS will now take that load and through the magic of physics make it ~42 pounds negating friction in the system. To make this load move we will have to generate a minimum pulling force of 42 pounds. Typically, a human on average can generate a pulling force of 30 pounds easily and with an effort up to 50 pounds -- well this 42-pound load should be okay to be moved by two rescuers being their total input or pulling force is at least 60 pounds.
- Here is where you will understand why we have the "Rule Of 18." We have five rescuers ready to haul this load and five rescuers multiplied by 50 pounds of input force each will generate a pulling force of 250 pounds. If any of the victim's limbs or packaging equipment should become caught on an obstruction during the hauling process, there is a good chance the team above won't feel that resistance, and the


result would be minor or severe injuries to the victim and/or gear damage with possible failure.

- Taking this example into account, during your size-up, you will need to calculate the MAS needed based on the fallen climber or "load" amount and the amount of personnel on scene.
- During this size-up, you also need to take into account the amount of rope you will need to use to build your system and also to evaluate the strength of the anchor needed to perform the rescue. Like every rescue operation proper planning and a solid skill base are a necessity.

3. Converting Rappel to Ascension

- a. Simply one can always resort to Texas prusiking after addressing the unconscious climber in a crevasse, though it shall be noted that the chest prusik shall need to be modified for its length to make this work manageable.
- b. Since students already know Texas prusiking, teach them another way to ascend the rope (i.e. by flipping the belay device into a guide made on their harness).

Reference Material: AMGA's Youtube Video (

 [How to Rappel Into and Ascend Out of a Crevasse](#))

- c. When the students are heavy (more than 200 lbs) ascending by flipping the belay device is not easily managed when needing to balance the weight and remove the slack due to friction (that depends on body weight). There is another system with a Garda hitch (alpine clutch) where they need to detach themselves from the belay device and install this Garda hitch instead of the device to reduce the friction.

Reference Material: Ortovox Safety Academy's Youtube Video on use of Garda hitch

(https://youtube.com/clip/UgkxUxcVw27ZDWJSn0xpkaO8y8kkea5_kSbL?si=zWV5L1GsSt0m_dHY)

Field Trip 3

Mindset

Solo Crevasse Rescue

Course Leader Thoughts

- Building upon FT2 to practice a full crevasse rescue scenario.
- Although students learned in their basic course how to set up a rope for a 3-person rope team, let's challenge the assumptions and provide logic on how we space between the climbers through discussion.
- Once the discussion is facilitated, divert their minds to learn more about setting up the rope for a 2-person team.

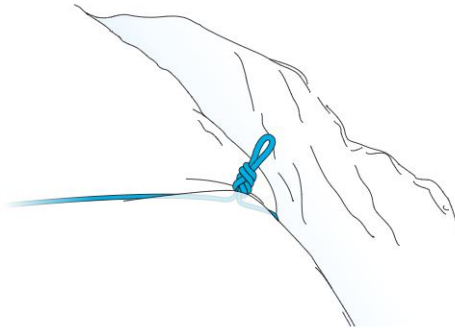
- Execute the Scenario: 2-person rope team that is self-reliant on a crevasse rescue situation of their partner who is unconscious.

Skills Covered

1. Rope Setup

- Factors to be considered for setting up the spacing between the climbers:
 - Average crevasse widths encountered on the trip (in WA cascades we most often navigate crevasses of width less than 2-3 feet, if found more, we navigate around them with protection)
 - Distance for self-arresting, given the conditions of the snow/firn, ease of travel that could mitigate falls (approx. 2? feet with competent climbers)
 - Minimum distance between the lip and arrest position (middle climber; buffer distance of 2-3 feet is helpful, for comfort of one's mind)
 - Number of team members available to arrest the fall.
 - This accounts to about 10 feet (7 arm's length). This changes based on location, remember the average crevasse width and whether the climber needs more space to arrest due to heavy loads such as sleds, etc.
- Need to rescue rope:
 - With a fallen climber, the rope typically stretches up to 30%. So this 10' spacing may become 13' between the arrest position (middle climber) and fallen climber.
 - When there is space between the arrest position (middle climber) and the lip to build an anchor, some of this distance can be disregarded. Simply put, have twice the length of the rope from the anchor, next to the arrest position (middle climber) to the fallen climber. 20' if using 10' spacing.
 - If time permits, ask a question if we need to carry rescue rope when traveling as a 4-person rope team.
- 2-person rope setup:





- When using the stopper knots (alpine butterflies or big bulky knots like glacier knots):
 - 6 feet of rope from the climber to the first knot (closest to that climber)
 - 3 feet of rope from the first to the second knot
 - 3 feet from the second to the third knot
 - Take note of the distance from the third knot to the middle of the rope, as it will help with an efficient setup:
 - e.g., if the desired distance between climbers is 40 feet, this will be 8 feet: $40/2 - (6 + 3 + 3) = 8$
- Factors to take into account when deciding to use stopper knots:
 - Knots are only effective on a wet glacier (snow); they don't work on dry glaciers (hard ice)
 - Must untie knots for belays
 - Must pass knots while prusiking out of a crevasse
- Be sure to choose the right size of a rope to begin with:
 - Enough in-between climbers to arrest crevasse fall (typically 40+ feet)
 - Enough in coils to drop a loop to the fallen climber during the rescue
 - Enough for all the tie-in and stopper knots (typically 2+ feet per knot)
 - In North Cascades, in practice, ~60m can work for a two-person rope team although a 70m rope would be more comfortable to work with
 - 60m rope = about 195 feet (but measure yours, as it can vary)
 - Subtract from this:
 - 40 feet distance between climbers
 - 12 feet captured in stopper knots (6 knots x 2 feet)
 - 4 feet in figure-8 on a bight (2 knots x 2 feet)
 - 8 feet in rewoven figure-8 (2 knots x 4 feet)
 - This leaves ~130 feet for the coils, or about ~65 feet per climber
 - Note this is less than twice the distance between climbers
 - The fallen climber won't fall the full distance (if they were to fall the full distance, both climbers would have fallen)
 - Fall is typically arrested by one of 3 stopper knots on the climber's side (the furthest of which is ~12 feet away)
 - One can always extend the drop loop with a long runner

- e.g., a triple makes up for ~12 feet of rope
 - Using a shorter rope requires greater care in tying the knots in the right places
- Other gear ready to deploy for rescue:
 - The picket and hammer are reachable and deployable with one hand while self-arresting
 - Slings pre-tied on pickets in a position depending on conditions:
 - Vertical mid-clip can be strong and fast but are unreliable if the condition of the snow is such that you cannot make a snowball (“snowball test”)
 - Vertical top-clip is fast, but also the least reliable, only use it on dry hard packed snow (not in early-season powder)
 - Horizontal mid-clip/t-slot is always an option, but very slow to deploy.
 - Generally, the strength of a t-slot picket increases with the depth at which the picket is buried.
 - A common rule-of-thumb recommendation is to bury the picket at a depth roughly equal to or larger than its length.
 - In reality, the strength of a t-slot picket will vary depending on the snow conditions. Much less than the picket length may be needed in hard snow, and more than this may be needed in an early season, unconsolidated powder.
 - Anchor materials (runners, biners, cordelette to equalize with block-and-tackle)
 - Rappel gear (ATC Guide or similar, extension, autoblock, biners)
 - Pulley/biner for drop loop, long runner if needed for extension of the drop loop
 - Progress capture (tibloc, microtraxion, etc.)
 - Pulley/biner/rope grab to add mechanical advantage; can reuse the waist prusik

2. Practice on the North Roof

Each student works by themselves to help a stranded rope team rescue their climbing partner.

Set-up/Rescue Stages:



1) Stranded rope team

- A rope team of 2 climbers; divided the rope into 5 lengths, with both climbers carrying $\frac{2}{5}$ of the rope (aka rescue rope).
- The person holding the fall has set up the anchor and has transferred the fallen climber's weight to it on a prusik with a backup knot.
- The fallen climber is unconscious and his partner is hesitant to rap down into the crevasse (lacking trust in his anchor-building ability and has also injured his arm while arresting the fall)



2) Safety of fallen climbers

- The fallen climber will be tied into 2 ropes.
- One of the ropes will be tied to the anchor 12 m from his tie-in point (butterfly knot) with $\frac{2}{5}$ of the rope (rescue coil) in his backpack or on his shoulder (kiwi coil).
- The fallen climber will also be tied into the second rope with a rewoven figure 8 (different color rope); when ready, he will be lowered on this rope using a munter until the first rope is loaded. The munter is then tied off with a mule overhand.
- An instructor can assist the fallen climber/rescuer on the wall by rapping down on a different strand to them during the rescue as needed.

3) Equalizing Anchors



4) Communication between the rescuer and the stranded climber

- It is important to establish communication throughout the process with the stranded climber.

5) Safely approach the crevasse (edge of the roof), and establish communication with the fallen climber

- The fallen climber is unconscious and hence provides no response, which confirms the finding as communicated with the stranded rescuer

6) Make a plan to quickly assist a fallen climber who does not respond and may require emergency first aid

- Build another anchor and equalize the load between the existing and the new anchor.
- Consider rappelling to an unresponsive fallen climber as the quickest way down. Both using a belay device or a munter hitch to rappel down are accepted.
- Check the fallen climber for any immediate attention for first aid.
- Set up your drop-loop onto the fallen climber's belay loop before ascending back up to the anchor (assuming the loaded strand is badly entrenched in the snow). Various ascension methods are accepted such as flipping the belay device in guide mode or garda hitch method accompanied by a friction hitch above the belay device/garda hitch to act as chest prusik; or any other creative way to efficiently switch from rappelling to ascension.

7) Raising systems

Note: If the loaded rope is entrenched into the snow, you may choose to abandon the loaded rope for the raise. This may require extra rope; either from a second rope team, or planned for by a single rope team with the end climbers carrying extra rope.

- After setting up the drop loop (2:1), the rescuer feels the need to improve the mechanical advantage to haul the fallen climber out of the crevasse.
- Any hauling system is acceptable.
- Bonus points: If you can state the steps...
 - to help the unconscious climber get over the lip
 - on how to secure the rescued climber
 - to check the integrity of the rope

Important Note:

This scenario doesn't cover for instance a variety of snow conditions and the impact from the presence of other rope teams.

Most real-life crevasse falls can be minimized by proper rope handling and good arrest, and typically won't need a hauling system.



Field Trip 4

Mindset

Small Party Rescue (Moving the fallen or injured climber away from technical terrain to camp or non-technical area to be evacuated by helicopter or large group rescue team heading up the non-technical approach trail or taking them to the care facility. One rope team (2-4 individuals) is available to assist in the rescue.)

Course Leader Thoughts

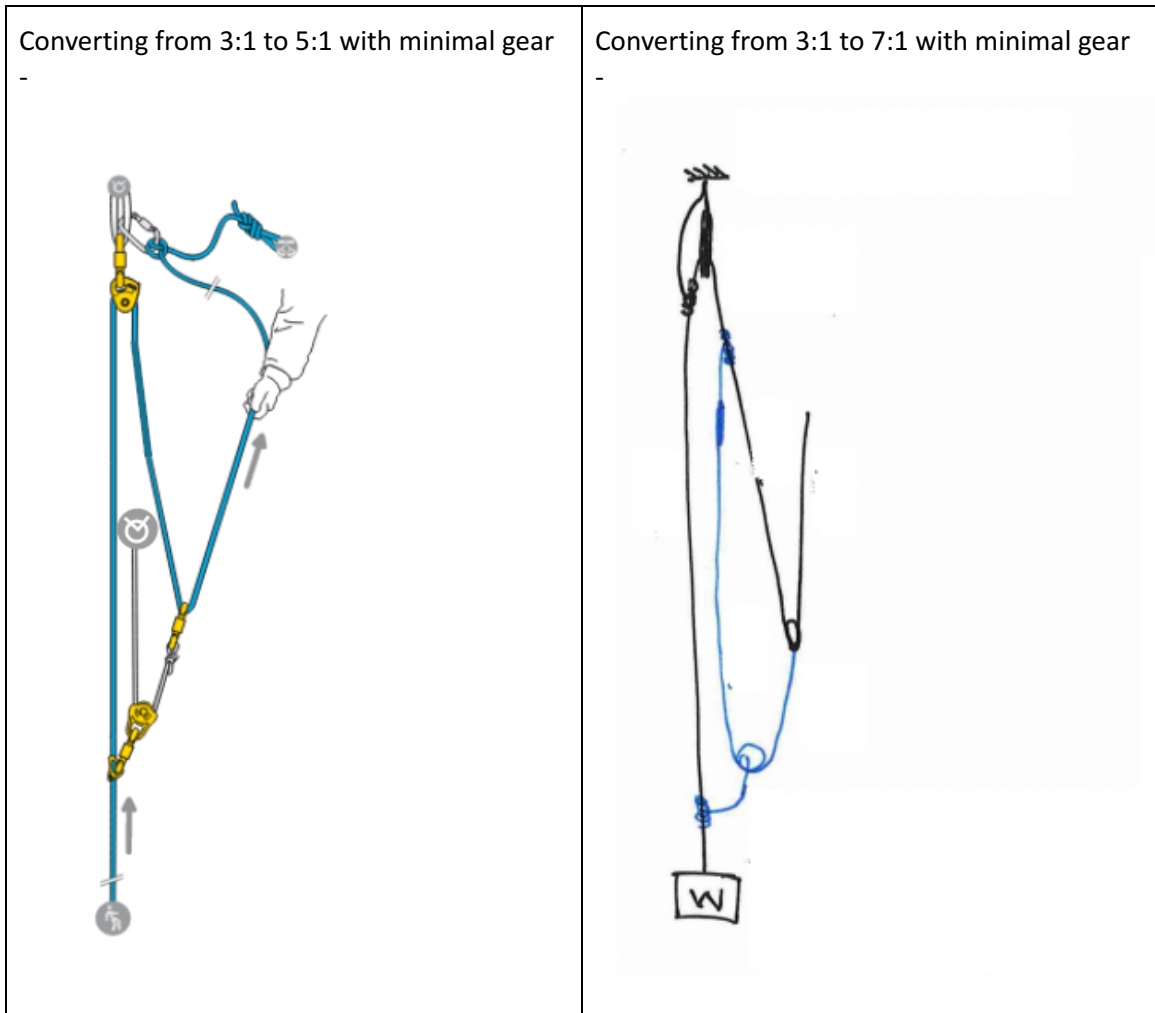
- Winter Mountaineering or otherwise, we encounter weather that was not forecasted and at times driven by summit fever. Such push in deteriorating weather can cause unforeseen situations starting with dehydration to injuries.
- Whether it is our team facing the rescue situation or other parties. Being on the mountain and realizing the incident has occurred, it becomes our moral duty and more often to have peace of mind after that - we decide to help others.
- Note, when doing so. Perform a scene size-up and your capability to help others before jumping in.
- Scenario: A team of 2-4 coming across another rope team in need of the rescue of their partner in a crevasse, who is unconscious and needs medical attention and is moved to non-technical terrain to receive assistance from a large group rescue team triggered from SOS/911.

FT4 Skills Covered

- Converting 3:1 to 5:1 or 7:1 (or 9:1 optional)
- Rescuer Attendant Tie-in
- Doing patient care when hanging in the crevasse or when raised/lowered together
- Communication with the team at the anchor
- Converting the lowering system (assuming the rescuer was lowered) to the raising system (raising 2 people)
- What if you rappel, how does the attendant tie-in look like, and other considerations?
- Transporting a patient in a guide tarp on a glacier or steep snow.
 - Lowering 2 people at a time
 - Converting lowering to raising
- Misc Topic (as time permits): Passing knots while...
 - Rappelling
 - Belaying
 - Lowering

References:

1. 5:1 and 7:1 hauling systems



2. Counting Mechanical Advantage: https://roperescuetraining.com/physics_calcmatssystem.php

Physical Conditioning

You need not be a competitive athlete or marathon runner to succeed in this course, but being in your personal best shape will increase your chance for success and will maximize your enjoyment in the alpine. A climber in poor condition may slow the party enough to prevent ever reaching the summit, or even jeopardize party safety. Inadequate conditioning also can contribute to a loss of alertness and an inability to respond properly to the demands of the environment.

There is no conditioning evaluation for this course but in order to succeed in the second Experience Trip and as a rope lead for glacier climbs you should maintain adequate fitness. At a minimum, be able to hike with a full day pack (20% of body weight but no less than 25 pounds and no more than 50 pounds) up the Mt. Si trail to the boulders (4 miles, 3400' gain) in under 2h. If you want to go on more strenuous climbs, two consecutive hikes of Mt. Si or equivalent in one day are a good measure for your fitness. Having completed such a hike will be a great perk when you apply for a strenuous trip.

If you would like more info on building an appropriate training plan, talk to an instructor, work with a personal trainer who specializes in mountain sports (Seattle has many), and check resources from [Uphill Athlete](#) and other books and websites.

Seminars & Clinics

If you are looking to expand your leadership role within the organization, consider taking the [Foundations of Leadership Course](#) and working towards [Climb Condition Leader](#) and [Snow Climb Conditioner Leader Badges](#).

The Climbing Committee also offers seminars and clinics that are not part of the Intermediate Course but may be valuable adjuncts to your alpine education. Watch for them on [mountaineers.org](#) and the Climbing Highlights e-newsletter which all Basic students receive. Some of such seminars and clinics include:

- Beta & Brews: This seminar provides beta on some alpine climbs in the Washington Cascades. These are scheduled once a month in Fall/Winter/Spring months.
- Leader Development Series: There are numerous seminars that engage students and leaders to develop soft skills that help us all on trips. This helps those who have an inclination to instruct at trips or plan to be a leader one day whether it is a private trip or for The Mountaineers.
- Basic Refresher Clinics: These clinics offer a great refresher session where past year Basic graduates can get together and practice some skills that they could be a little rusty on before going out on climbs.

Club Standards

The Mountaineers have agreed on [Member Code of Ethics](#) and [Standards of Participant Conduct](#).

- Act ethically and respectfully to contribute to a safe and engaging learning environment;
- Engage with all other members with integrity and honesty;
- Follow Mountaineers policies, including behavioral policies and procedures, such as the Member Code of - Ethics and Problem Behavior policies;
- Treat people with dignity, respect and compassion to foster a trusting environment free of harassment, intimidation, and unlawful discrimination;
- Will raise any safety concerns as they arise to ensure a safe environment for all;
- Not harass, bully, threaten or discriminate against any member through any means

The Mountaineers is a heavily volunteer-driven organization and most leaders are volunteers. It is expected that leaders, in any capacity:

- Have the necessary skills and experience to competently manage the risks associated with activities they lead and/or instruct for both themselves and others;
- Act for the benefit of The Mountaineers and furthering the mission and goals of the organization;
- If relevant, share any conflicts of interests, real or apparent, that may compromise objectivity when representing The Mountaineers during any activities like volunteer selections or investigations;
- Promote relationships based on mutual respect, fairness and openness;
- Not use a position of authority within the organization for inappropriate coercion of another individual;
- Ensure fair and inclusive hiring, promotions, or appointments for all positions, including of volunteers;
- Complete incident reporting accurately, honestly, and promptly;