

WMCR 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.)

FT4 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. It is our obligation as leaders to be prepared to provide assistance.
- 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.
- With such a scenario, we could follow the steps below as one of the ways to assist (note there may be other ways or considerations that may be warranted with similar scenarios like these):
 - Ask questions to help ensure you get the right picture of the situation/scenario and see if you have the skills to assist.
 - Is the fallen climber okay?
 - Does the team attached to the fallen climber feel competent to perform the rescue?
 - If not, what help or assistance could be beneficial?
 - This scenario assumes that the fallen climber needs immediate first aid as the ice inside the crevasse did cut through their calf as they were falling. The rope team attached to the fallen climber is exhausted to do the rescue themselves. Also the weather isn't helping the team. Worst case scenario!
 - If you decide to assist, discuss with your team the need to build a new anchor system and or trusting their anchor, same for the rope.
 - If you decide to use their anchor system and rope, most of the skills are similar to FT3, except that we can go over the patient care when hanging in the crevasse.
 - If you decide to build a new anchor and use your own rope to rescue the fallen climber, this FT assumes this scenario and walks you through different parts of the rescue.
 - Once the anchor is built, you can decide to rappel down on the new rope and be lowered. Since we won't be using their rope, it is crucial that we have a system to connect the fallen climber to our (new) rope. **See Rescuer-Patient / Attendant-Subject Tie-in.**
 - Getting to the subject and caring for them takes time. So after attending the immediate first aid needs, it may be helpful to improve blood circulation in their legs and if they are upside down, to make them upright. **See Patient Care.**
 - Communication with the team at the anchor when ready to be hauled.
 - Your team at the anchor can now prepare to set up a hauling system and raise you both over the crevasse lip and get you to the anchor. **See lowering to raising conversion and also 5:1; 7:1 or 9:1 hauling systems.**

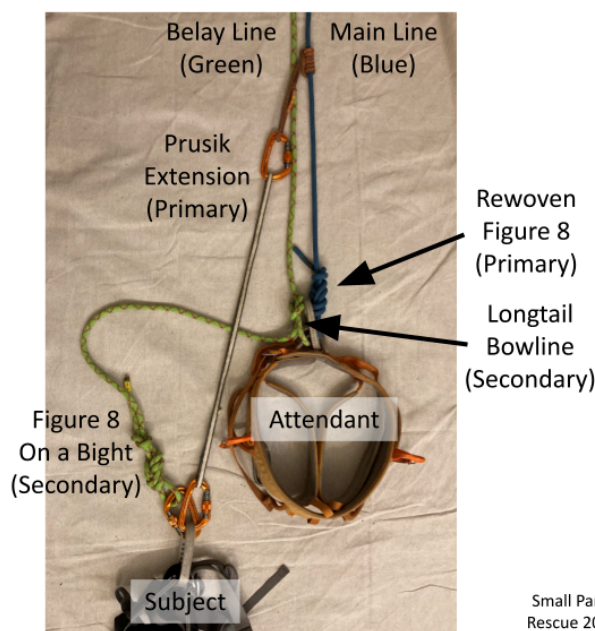
- Once everyone is at the anchor, the next step would be to see if further assistance is needed to move the subject to the camp or back to the trailhead. In a dry environment, we would need a litter, but in snow covered areas (most likely in winter or back to the camp/trail network in summer) we could devise a backcountry sled using a tarp. A picture of a litter is shown below. **See transporting a patient in guide tarp.**



- At times, you may encounter steep slopes to traverse or to travel down. With a patient in a sled, it may be wise to lower the patient to have the movement be in control at all times. And also, have someone attending the patient while being lowered. **See lowering 2 people at a time.**

FT4 Skills Covered

- Rescuer-Patient / Attendant-Subject Tie-in
 - When rappeling to the fallen climber
 - Once you are a little below the subject to take care of them, tie a back-up knot below your rappel system.
 - Within the next few feet below your backup knot, do a figure of eight on a bight and clip it to the subject's harness. Now you both are connected to the new rope.
 - If and when your team will haul both you and the subject, once you do the first aid, the subject will be below you with this setup. In order to avoid this, take a sling or a cordelette to have them above you at all times. This attachment can be to your rappel setup or to a friction hitch above you (as shown in the picture)
 - Note: In the picture, please assume that the blue rope is not there and the friction hitch shall be on the green rope.



- When lowered to the subject
 - Connect yourself to a butterfly a few feet off from the tail.
 - Have a figure-of-eight knot ready at the end of the tail to be able to connect to the subject's harness.
 - Once you are just below the subject, do the rest similar to when you would do when you have rappelled to the subject.

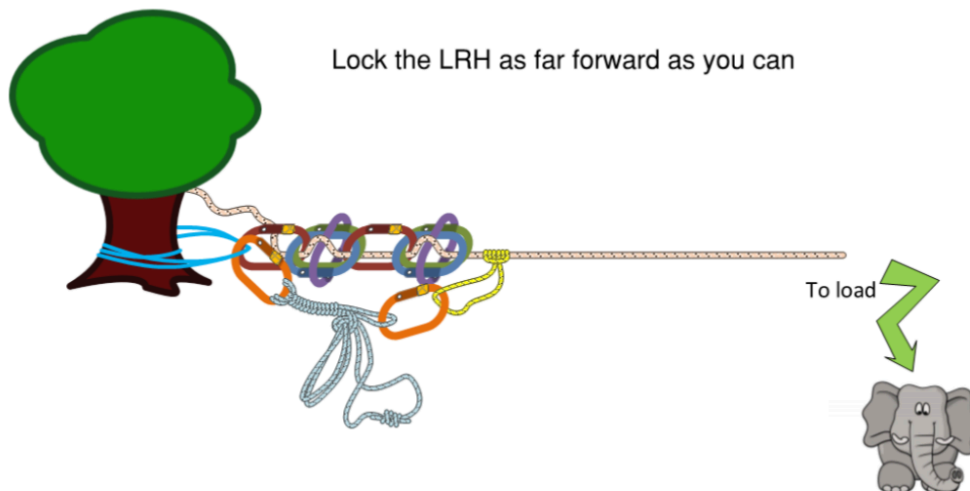
- Patient Care

Doing patient care when hanging in the crevasse or when raised/lowered together; Improving blood circulation in the legs and not having them go upside down; also to create a platform to monitor them for the remainder of the rescue.

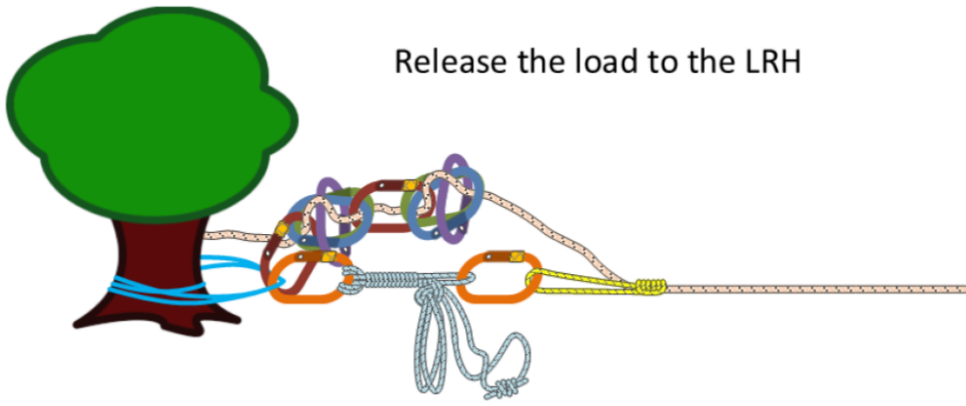
- Use their chest harness (if present already) or improvise to use your or their slings and to connect the shoulder straps to the high point as shown below (left and middle sketch).
- It also may be useful to pad their legs and pass a sling around it and connect to the same high point (as shown in the right sketch)



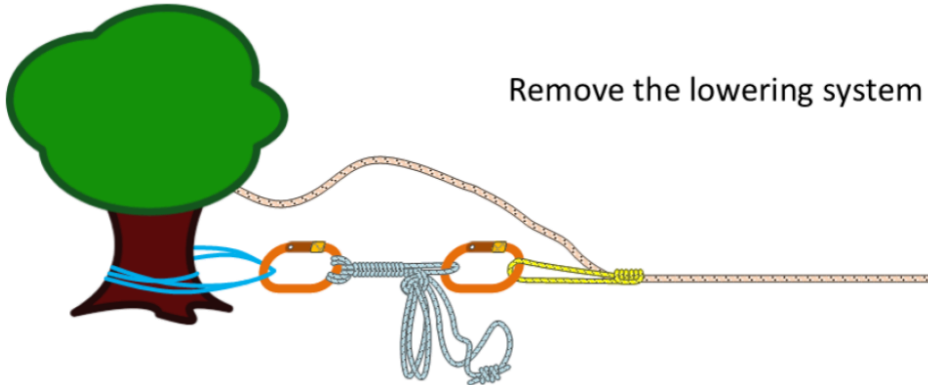
- Converting the lowering system (assuming the rescuer was lowered) to the raising system (raising 2 people)



Release the load to the LRH



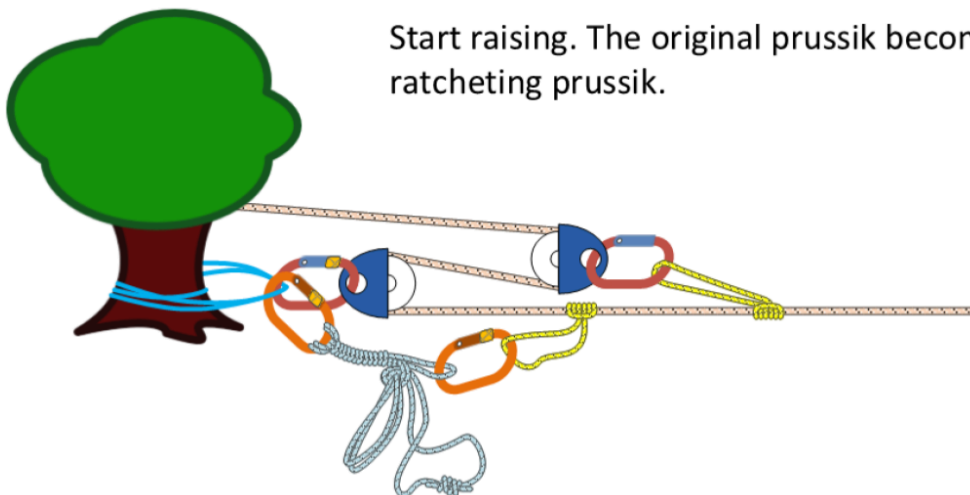
Remove the lowering system



Note: it is HIGHLY recommended you close the system with a clove hitch backup before completely removing the lowering system

Set up the raise using the loose end of the rope. A 3:1 is shown here. Change it to 5:1 or 9:1 based on your load and pulling force.

Start raising. The original prussik becomes your ratcheting prussik.



- 5:1, 7:1 & 9:1 hauling systems

Converting 3:1 to 6:1



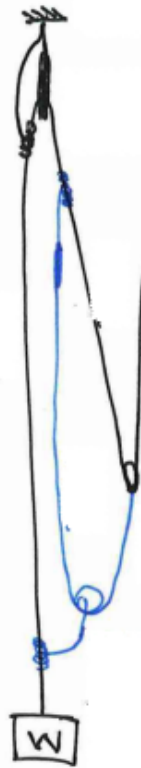
Converting 3:1 to 9:1



5:1 Hauling System



7:1 Hauling System



- Counting mechanical advantages + Rule of 18 / Load on anchor

Reference: https://roperescuetraining.com/physics_calcma_tsystem.php

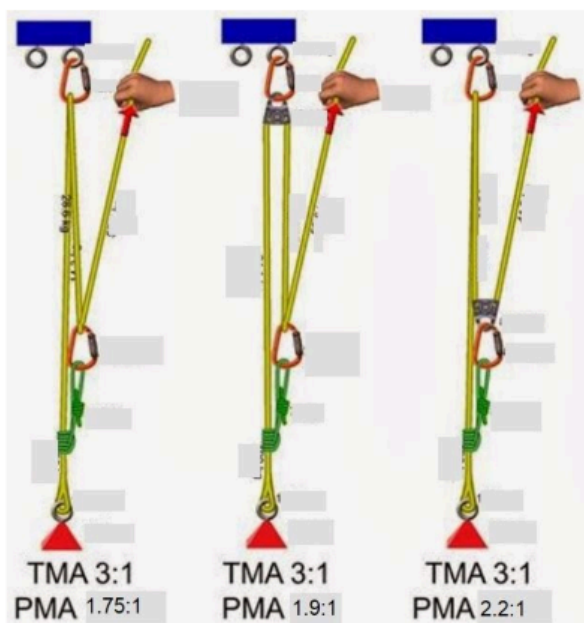
Calculating MA using the T-System

- The T-System, which is sometimes referred to as the T-Method or the "adding the tensions" method, is a versatile way to calculate the mechanical advantage of a rope-and-pulley system. Although the T-System may appear complicated, it really isn't. The only math that is required is adding a few one-digit numbers.
- The T-System can solve relatively complicated systems. However, the T-System cannot solve every system imaginable. It works great on simple and compound rigging systems, but it can get overwhelmed by some complex systems.
- The T-System always assumes that the pulleys are frictionless and that the ropes make 180-degree turns around the pulleys.

Pulley Efficiency

Pulley Efficiency

- When rope goes through a pulley, there are some losses due to friction
- Carabiners are roughly 50% efficient
- If you have only 1 pulley, the most important location is the pulley closest to your pulling hand that affects Mechanical Advantages



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Rule of 18

There is something called the "Rule of 18" that we must adhere to. Basically, 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 4:1 MAS (mechanical advantage system). We'll take the number of rescuers used and multiply that number by the first number in the MAS 4:1. If we have four rescuers we would multiply 4×4 which equals 16. Sixteen is under 18 so we are in good shape. If one more rescuer were added to the team, we would exceed our rule of 18 ($5 \times 4 = 20$).

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. 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 easily 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 end 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.

- Transporting a patient in a guide tarp.

Reference Video on how to use the guide tarp: [Ski Guide Rescue Tarp - YouTube](#)

- Lowering 2 people at a time

The thought behind the skill is to be in control

- Technique 1: Using a monster-munter



- Technique 2: Adding a second system to your existing lowering system used to lower a one individual

