

## Low Angle Rescue – Module #8

The Low Angle Rescue module consists of two parts:

1. Knot tying and Anchoring (demonstrated at a separate station).
2. Setting up and executing a properly constructed **rope rescue** litter lowering and raising system with a 3:1 mechanical advantage.

### KNOT TYING and ANCHORING

The candidate will demonstrate the ability to tie the following knots.

- Figure 8 Follow-through
- **Figure 8 on a bight**
- Prussik Knot
- ~~Bachman Knot~~
- Double Fisherman's
- Water Knot or Ring Bend
- Munter Hitch
- Hasty Seat

The certified candidate will demonstrate the ability to construct a variety of anchors and anchoring systems.

- Knotless Anchor
- Single Anchor
- Two-point Equalized Anchor
- Three-point Equalized Anchor

### LOW ANGLE RESCUE SYSTEM

The certified candidate will define LAR and describe when a LAR will be appropriate. The candidate will construct a Low Angle Rescue System with a 3:1 Mechanical Advantage. The candidate will demonstrate the use of this system for ~~both raising and lowering~~ a rescue toboggan. This system will include:

- ~~Stout~~ **Appropriately selected** anchor(s) w/sling and locking carabiner. This can also be a multiple anchor system that is equalized.
- Rope secured to litter or **rescue** sled with **webbing** slings, carabiners and Figure 8 knot.
- Rope run to provide a 3:1 mechanical advantage for raising.

- Prussik knots or ascenders attached properly to ensure system backup.
- Slings on litter for two rescuers
- Hasty seat on candidate
- Figure 8 or Munter hitch used for lowering.

~~In accordance with NSP policy and in the interest of risk management, the Low Angle Rescue component will not include the actual lowering of people.~~

This is a relatively new module with much expected of the candidate. We expect a skill level higher than what we might think is acceptable from a regular patroller. The candidate should demonstrate the ability to perform the skills without a lot of hesitation, floundering or mistakes. If a mistake is made, it is acceptable to correct it in a timely manner that does not compromise safety or operational status of the system.

**Candidates should, at all times, treat rescue equipment and lines with respect.**

### **Suggested equipment for a low angle rescue kit:**

- 150 feet of 11 mm static line
- 100 feet of 1 inch tubular webbing to make 2 – 20' and 4 – 15' lengths
- Locking carabineers - 10
- Harnesses – 2 sets, make sure it can fit over ski boots
- Pulleys – 2 (preferably 1-1/2" to 2" in diameter)
- Belay device – (Figure 8)
- Safeties, 5mm line – 41' (cut to 6 – 5-1/2' and 1 – 8')
- Rope Bag (to put all your stuff in)
- Small mesh bags – 2 (to store carabineers etc and tubing)

[Recommended course of study for LAR Module](#)

Complete, and/or re-take for review, the NSP Mountain Travel and Rescue 1 course (MTR1)

Reading (available through the NSP)

*Mountain Travel & Rescue: National Ski Patrol's Manual for Mountain Rescue*, Mountaineers Books; 2nd edition, National Ski Patrol

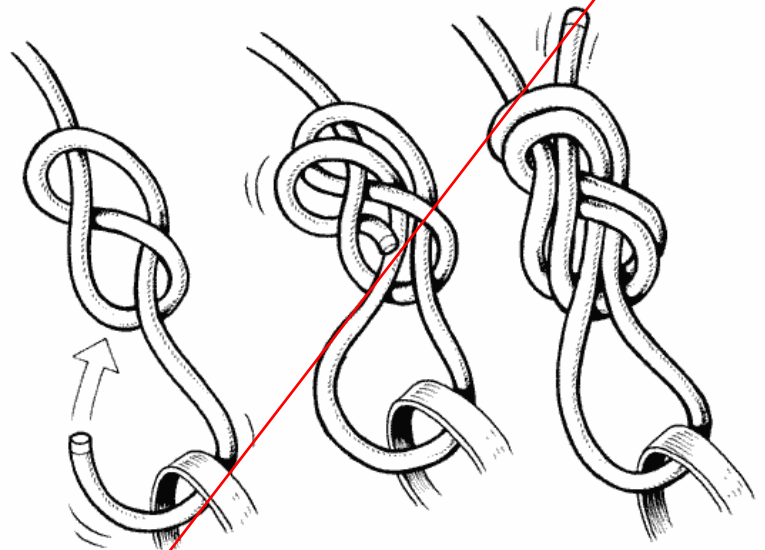


## Knot Tying

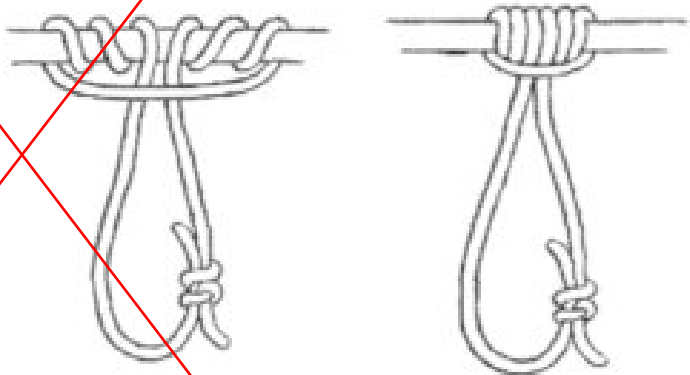
**Objective:** The certified candidate will demonstrate the ability to tie the following knots.

**FIGURE 8 FOLLOW THOUGH:**

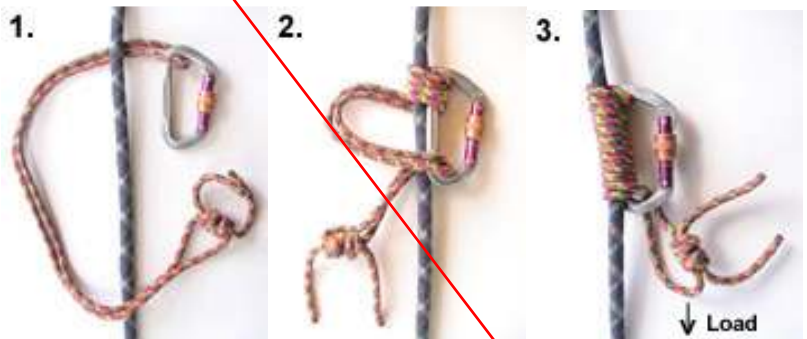
Used for attaching end of rope to rescue equipment or to a harness. A single figure 8 is tied, sent through the equipment and then retraced back to its starting point. It should be backed up with an overhand knot.



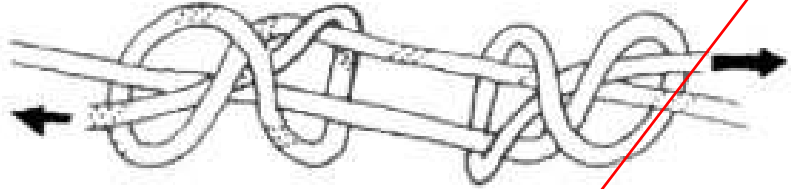
**PRUSSIK KNOT:** Used as a backup to a belay device. Can also be used to ascend a line. This knot will grip the rope when force is applied and slide when it is loosened. Shown is a three-wrap prussik.



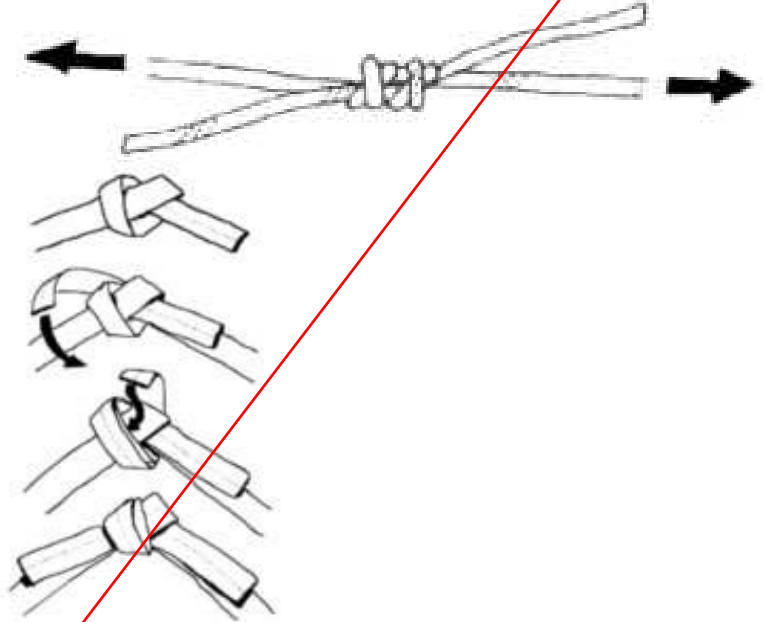
**BACHMAN:** Another friction knot. One end is put through the carabineer. It is then wrapped around line and carabineer at least three times. Carabineer should be locked when complete. Can be used with cordage or webbing.



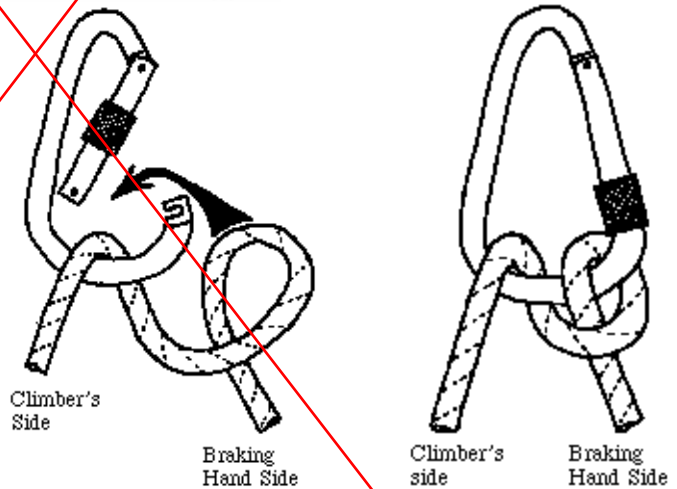
**DOUBLE FISHERMAN:** Used to tie two lines together. It is a very strong and compact knot that is easily tied. Difficult to untie once it has been loaded.



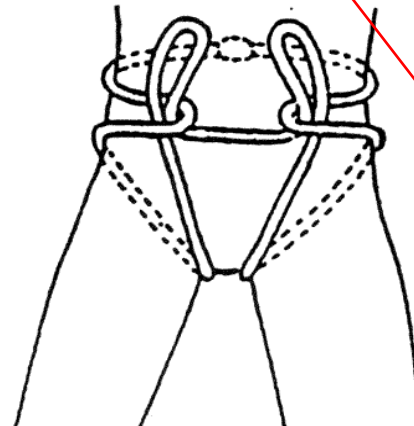
**WATER KNOT or RING BEND:** Used for joining either tubular or flat nylon webbing. Tie a loose overhand knot in one piece of webbing. Follow the overhand knot back through. It should be backed up with an overhand knot leaving tails 2" or longer.



**MUNTER HITCH:** An excellent self-reversing friction knot suitable for belaying. Used when Figure 8 or Sticht plate is not available.



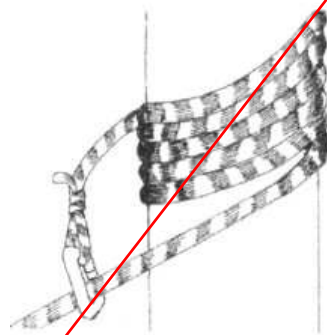
**HASTY SEAT:** Used with tubular webbing for a harness.



## ANCHORING

**Objective:** The certified candidate will demonstrate the ability to construct a variety of anchors and anchoring systems.

**KNOTLESS ANCHOR:** Used to secure the end of a stationary line. At least 3 wraps are made around a Bombproof Anchor (BFA - Big Friendly Anchor).

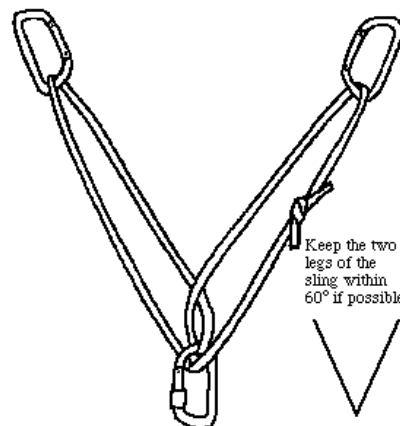


**SINGLE ANCHOR:** Used to secure to Bombproof Anchor (BFA - Big Friendly Anchor). Two pieces of webbing should be used.



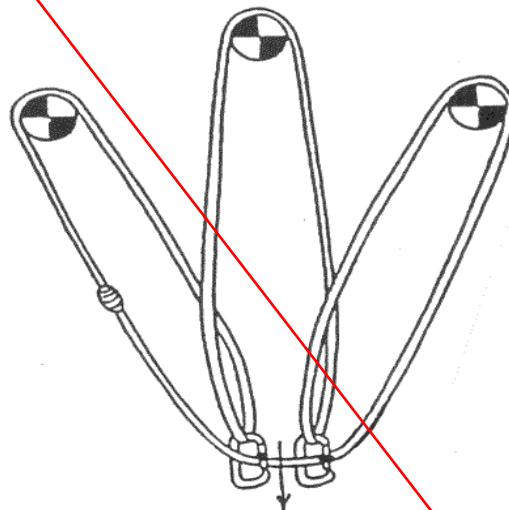
**TWO POINT EQUALIZED ANCHOR:**

When a BFA cannot be found an anchor system must be used. Two or more points are connected together to share or equalize the load. The webbing is twisted to allow the knot to 'slide' in case of a load shift. Also, if one anchor should fail, you would still be connected.



**THREE POINT EQUALIZED ANCHOR:**

Here three points are used to distribute the load. Again note the twists in the webbing



## LOW ANGLE RESCUE SYSTEM

### **Objective:**

The certified candidate will define LAR and describe when a LAR will be appropriate. The candidate will construct a Low Angle Rescue System with a 3:1 Mechanical Advantage. The candidate will demonstrate the use of this system for both raising and lowering a rescue toboggan.

A low angle rescue situation is one where rescuers can easily scramble without using their hands against the slope for balance. This may be a slope where a fall would result in a tumble but would not be fatal. If rescuers must rappel down it then this would be a high angle rescue. If there is any significant danger below the slope, such as a cliff or dangerous water this also should be treated as a high angle situation. The most likely scenario for a low angle rescue would be when a skier has skied off a trail down into an embankment.

A 3:1 mechanical advantage allows the rescuers the ability to haul using 1/3 the effort. This is achieved through use of pulleys. With a 3:1 MA 3' of rope must be pulled for the load to move 1'.



The load would be a toboggan or stokes basket. Every rescuer that descends should be attached to this with a hasty seat sling or harness.

The rescue line will be secured to the toboggan with a follow through Figure 8 knot.

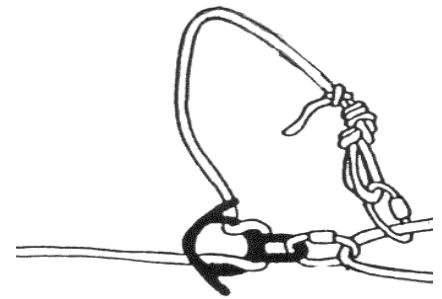


A pulley will be fixed at the anchor (orange webbing). A backup (Prussik shown –

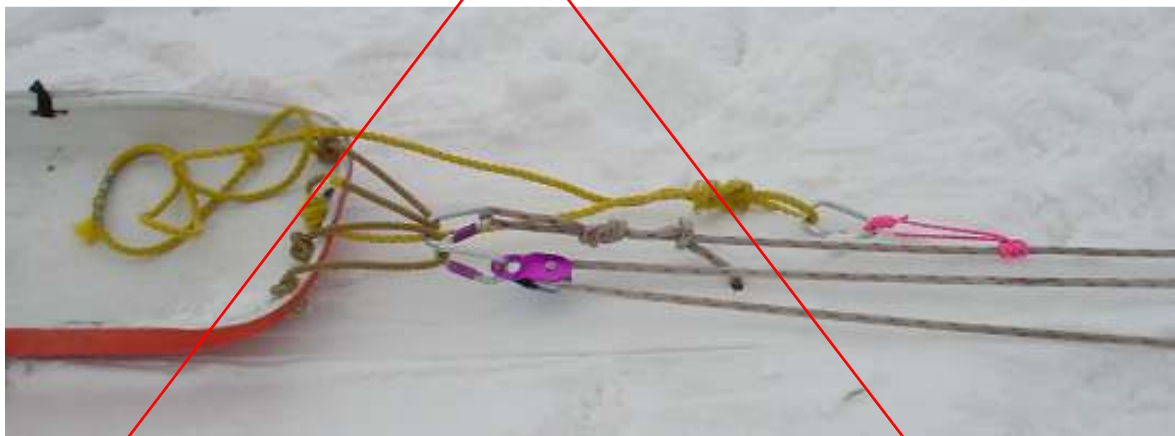


pink line/ purple webbing) should be established in front of the pulley in case of system failure. One rescuer will be needed to monitor this during lowering and raising.

The line should go through a belay device (Figure 8, ATC, etc.). This end of the line will also be tied with a follow through Figure 8 knot (anchored to yellow webbing).



The belay device will be used to lower the load. When the load is raised all slack will be pulled through the belay device.



Shown above, a Prussik is attached to the tail rope as a static backup. Should there be a failure in the knot, carabineer, or handles then the tail rope will provide a backup anchor.