

# NCRC Instructor Guide

Compiled by John Punches, National Coordinator  
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This guide summarizes the key tenets of NCRC methods. It is not intended to represent our entire curriculum, but rather those central elements upon which the curriculum is constructed and those points most commonly misstated. It emphasizes methods considered by the NCRC Board of Regional Coordinators and Education Committee to be critical to safe and effective *teaching* of American cave rescue techniques. It summarizes the ever-elusive “NCRC Way.”

There are many ways to conduct cave rescue. Some work better than others. All are situational. Caves present unique challenges that prevent any single protocol from having universal application. Your job as an NCRC instructor is to ensure your students have learned the methods described in the NCRC curriculum. That accomplished, you are permitted (even encouraged) to teach other methods provided they are safe and effective. *Remember that what may be safe and effective for an experienced, competent cave rescue technician may be unsafe and ineffective with your particular group of students. Also remember that students will get checked off on NCRC methods – so don't overload them with options that will confuse them at check-off time.*

Knots instructors should know

- Figure eight on a bite
- Figure eight follow through
- Double figure eight
- Butterfly knot
- Bowline ***Backup knot required*** (Yosemite acceptable)
- Double overhand bend (double fisherman's knot)
- Ring bend (water knot) in webbing
- Half hitch in webbing ***Use three in succession***
- Overhand knot ***Use as backup knot***
- Square knot ***Backup knot required***

Hitches instructors should know

- Clove hitch ***Backup knot required if end of line***
- Trucker's hitch
- Münter hitch
- Prusik hitch
- Tandem prusiks

## Anchor Techniques

- Single point techniques
  - Wrap-3, pull 2 (knot in non-loaded wrap, facing load)
  - Wrap-2, pull 1 (knot in non-loaded wrap, facing load) *Single person load only*
  - **NOTE: the Wrap-pull techniques are generally done with webbing, but can be done with rope. Use rope if you lack webbing long enough to encircle the anchor point – tying multiple pieces of webbing together defeats the purpose of the technique.**
  - Round turn/tensionless wrap (no load on knotted end)
  - Basket rigging (keep knot out of load if possible)
  - Do not girth hitch
- Multipoint techniques
  - Load Sharing (two or more fixed length “legs” extending from anchor points to a stationary focal point)
  - Load Distributing (two or more variable length “legs” extending from anchor points to a movable focal point – commonly known as “self adjusting anchor” or “self equalizing anchor”) **Keep “adjustment” length as small as feasible to minimize potential shock load if an anchor point fails. Level 3 skill.**
- Concepts
  - Keep angle between “legs” less than 120 degrees, preferably less than 90 degrees. (120 degrees is “critical” angle beyond which forces in legs are multiplied – going beyond this angle should be done only with careful attention to anticipated forces.)
  - Avoid cross-loading carabiners – use delta links if necessary
  - Back up anchors that are not “bombproof”
  - Rig high to reduce edge friction
  - Rig low on anchor point or stabilize with back-tie if anchor point is “small”

## Belays

- Construct to withstand anticipated shock load should mainline fail (use a strong anchor)
- Use low stretch/static line
- Operate with gloved hands
- Keep slack to minimum needed for efficient use
- Do not allow belayer to become “part” of the system
- Avoid redirecting belay line unless absolutely necessary
- Münster hitch acceptable for single person loads
- Tandem triple wrapped prusiks required for rescue loads or high angle applications
  - Use PMP with prusiks for raise
  - Use prusiks only for lower (OK to leave PMP in place if using excellent operating technique – if any doubt, take PMP out)
  - Ensure short prusik is just long enough to clear PMP
  - Ensure long prusik is at least 4 inches longer (when rigged) than short PMP
  - LRH required when lowering, recommended when raising

- Use of “new” belay devices (540 belay or nano belay) allowed in controlled environments as test of devices’ capabilities

#### Belay Technique for Tandem Triple-wrapped Prusiks during lowering operation

- Operate with gloved hands
- Slide long prusik back until it contacts short prusik
- Grip both prusiks between fingers and palm of hand nearest anchor, rotated 90 degrees from direction belay rope would run under load. Do not wrap thumb around rope. Keep back prusik, LRH and anchor components lightly tensioned throughout belay process.
- Using fingers and palm (not thumb) of other hand, grip rope just beyond prusiks on side toward load. Strip out approx 1 foot of rope at a time, pulling up through prusiks then pushing hands together to form bight of rope.
- Allow this bight of rope to slip through load-side hand as load is lowered, until bight is nearly gone, then strip out another bight of rope. Keep pace with lowering operation. Do not allow more than approx 1 foot of slack to develop.

#### Mainlines

- Support load in raising or lower operations
- One part of system (used in combination with belay)
- Use rack with welded eye for rescue load lowering
- Use PMP with single triple wrapped prusik for progress capture in raising operation
- Redirect if needed to reduce friction

#### Load Releasing Hitch

- Current “standard” is 3:1 Radium Hitch in 8mm cord (see illustration)
- Others are acceptable provided they are safe and effective

#### Hauling Systems

- Use lowest mechanical advantage system that will accomplish the job
- Limit to 12 persons pulling (equivalent) for 11mm rope (e.g. 12 persons on 1:1 or 4 persons on 3:1)
- Limit to 18 persons pulling (equivalent) for 12.5mm rope (e.g. 18 persons on 1:1 or 2 persons on 9:1)
- Pull by hand unless well below “limits” of pull
- Design systems for maximize pull length between resets
- Redirect if necessary to allow haul team to work more efficiently, increase safety, minimize confusion near edge, etc.
- Use “haul, set, slack” command sequence for efficient function
- Locate progress capture device where it will work efficiently and safely (note that PCD on even-numbered systems may be placed at main anchor if desired – see illustrations)

### System Safety Ratio

- NCRC general standard is 7:1, based on evaluation of component load ratios under mechanism of use. Note this is new as of Feb 2006, but is not significantly different than our historical practice (the new version just explicitly accounts for knots and other configuration implications).
- Safety Ratio is our reference point – calculate component load ratios (as configured) and determine if weakest link meets our criteria

### Safety

- Utilize a safety officer or officers to check systems before using for life support (someone who did not do the rigging)
- Double check harnesses and personal equipment before loading
- Wear helmet when in cave, work area or drop zone
- Wear gloves when handling moving (or potentially moving) rope or litter
- Wear personal protective gloves (and other PPE) if administering first aid
- Use proper lifting techniques
- Clip into safety line if within body length (or 6 feet) of steep slope or cliff edge
- Avoid rigging directly over patient or other persons unless absolutely necessary
- Use QAS appropriately – it is intended for work positioning and fall prevention – not fall protection (in other words – it should be used to keep you from falling, not to catch you if you fall)

### Rappelling

- Use one of the NCRC-approved devices
- Wear gloves
- Employ bottom belay or self belay if unsure of skill
- Use “hard” tie-off if hands need to be free (loop and twist with hyperbar or bobbin, double wrap and overhand knot on loaded line if standard rack or figure-eight with ears)

### Ascending

- Maintain two gripping points of attachment at or above center of gravity at all times (including rebelay, changeovers, pickoffs, etc.)
- Gloves optional
- Pad and position rope to prevent “bounce” damage

### Counterbalance

- Use anchor suitable to load (will be at least two persons, could be more)
- Employ mechanism to control rate of ascent/descent
- Employ mechanism to capture progress and protect against loss of control
- Note three general categories (see illustrations): Rappelling Counterbalance, Climbing Counterbalance, Diminishing Loop (closed loop) Counterbalance.

### Level 3 skills (details available in Level 3 curriculum)

- Highlines
- Guiding lines
- Twin tensioned traverse
- Rebelays
- Load distributing anchors
- Bolting
- Rock protection (as applied to cave rescue)
- Water problems
- Systems without traditional belays

### Edge Problem Options

- Rig mainline high where safe and functional (keep belay line low)
- Use most efficient orientation of litter (unless medically contraindicated)
- Minimize load (have litter attendant climb separately, at least near edge)
- Pad effectively
- Use multiple edge attendants on separate lines
- Use tag lines

### Commands (not including highline commands)

- Stop!!! (Everyone stop)
- Stop, stop, why stop? (Why has movement stopped, or why is progress delayed. Usually a question from the litter attendant.)
- Up! (Haul the rope/load up. May be qualified as Up Slow, Up Fast, etc.)
- Down! (Lower the rope/load down. May be qualified as Down Slow, Down Fast, etc.)
- Tension! (Usually Tension Main or Tension Belay. Take any slack out of the line but don't lift/move the load.)
- Slack! (May be qualified as Slack Main or Slack Belay, or quantified as Slack Main One Foot, etc.)
- Haul – Set – Slack (commands used to manage the haul system)
  - Haul – pull on the haul line. Issued by the person who has just completed resetting the haul block.
  - Set – slowly release tension on the haul line and ensure the progress capture prusik/device is engaged. Issued by the person best able to see when the team can make no more progress.
  - Slack – drop the haul line and move the haul block and its point of attachment back toward the load – essentially the command to “reset.” Issued by the person best able to determine that the PCD has engaged.
- On Belay! (Command to have belay ready. Response is Belay On or On Belay)
- On Rope! (Statement informing others that you are “claiming” a particular rope for your activities.)
- Ready to Lower? (Command question from team leader to determine if all functions are ready for lowering operation. Responses would be Mainline Ready, Belay Ready, Edge Ready, Litter Ready)

- Ready to Raise? (As above but for raising operation)
- Falling! (I am falling, or someone else is falling)
- Rock!!! (Something is falling)

#### Pickoffs

- NCRC teaches several types, and there are variations on each. Each level has specific, step-by-step instructions
- All should be done to maintain two points of gripping contact while in ascending phase
- Lower devices should be locked off with “hard” tie-off while preparing for lowering phase
- Lowering devices should be tested under load before removing last point of gripping attachment
- Patient and rescuer should be linked by tether/pick-off strap
- NO CUTTING IS ALLOWED

#### Patient Packaging

- Patient must have seat harness and belay attachment for any vertical movement. Belay line exits package from neck hole in package.
- Patient must be protected from environment (vapor barrier and insulation)
- For transport in Ferno (or other solid basket litter), helmet should be removed and use of spinal immobilization is optional (dependent upon injuries and local protocol)
- For transport in SKED, helmet is generally utilized and use of OSS or KED with shoulder-board is required
- Spinal stabilization and head immobilization, if needed, must be accomplished using a spine splint (such as the OSS)
- Two tie-in systems are “recommended” for use in solid basket litters
  - Double V method in which patient is secured in seat harness by a “V” of webbing running across the shoulders and girth hitched through the harness. A second inverted “V” girths the harness and attaches to the foot end of the litter to prevent patient movement toward the head of the litter. These restraints are tied snug, but not tight in most situations. Packaging is then completed and the patient restrained with commercial or improvised cross-straps outside the packaging. The packaging must be layered in a manner that allows the lower “V” to function without disrupting the vapor barrier’s function. Other packaging aspects remain the same as with our previous technique (below). A footloop should be incorporated if not medically contraindicated. (See accompanying illustrations for more detail.) The footloop is intended to serve as the primary mechanism of support for the patient if injuries allow. Support by the seat harness is an advanced technique, with serious harness hang implications, and should be avoided whenever possible. (This clarification was adopted May 2007.)
  - NCRC method using crossed shoulder straps over blanket roll, secured foot loop, and cross-body straps. All lashing occurs outside of the packaging.

## Litter Rigging

- Mainline and belay line both attach to basket spiders or bridle via inline knot (butterfly, inline figure eight, long tail bowline). Interlacing is optional.
- Tail of mainline becomes litter attendant line. Clips to attendant's harness. Attendant positions himself using ascenders.
- Tail of belay line becomes patient's belay attachment. Enters package through neck opening and attaches to harness. May utilize a tether from harness out of package to facilitate quick attachment/disconnect with system.
- Position spider carabiners with gates in and down (i.e., spine toward outside of litter, opening end of gate down)
- Position other carabiners with gates facing away from cliff and opening end down.
- If using a low rigging point on litter, rig to avoid rope/webbing abrasion between litter and cliff, maintain the integrity of the belay line, and keep both mainline and belay line connected during the load supporting stages of the evolution.

## Medical

- NCRC teaches at the Basic Life Support level. This means NO invasive techniques, drugs, reduction of dislocations, setting of broken bones, etc.
- NCRC teaches its students how to apply basic life support techniques in the cave environment. This includes patient assessment, control of bleeding, splinting (including use of the OSS), and basic treatment of hypothermia.

## ICS

- NCRC teaches ICS as applied to cave rescue incidents. While efforts are made to remain true to the central tenets of ICS, some customization is employed to make the system function well in the cave environment.
- Level 1 students get a minimal introduction to ICS that covers its hierarchical nature and general characteristics, and stresses their need to work within the chain of command and sign in/out.
  - Command Staff = IC, Safety officer, Public Information Officer, Liaison Officer
  - General Staff = Ops, Plans, Logistics, Finance
- Level 2 students receive information on task force leadership, the common types of task forces employed in cave rescue, briefing and debriefing, and reporting options under different potential chains of command.
  - Task Forces in Cave Rescue: Search, Initial Response (known patient, known location), Rigging, Communications, Evacuation, Medical, Equipment Transport
- Level 3 students learn how to function as an initial IC, as members of the command staff, as resource unit leaders, and as "rescue specialists."
- NCRC teaches the concept of an Underground Coordinator (and discusses its various potential ICS titles) as an option for managing cave rescues.
- Note that what NCRC teaches is consistent with NIMS ICS (the new stuff)