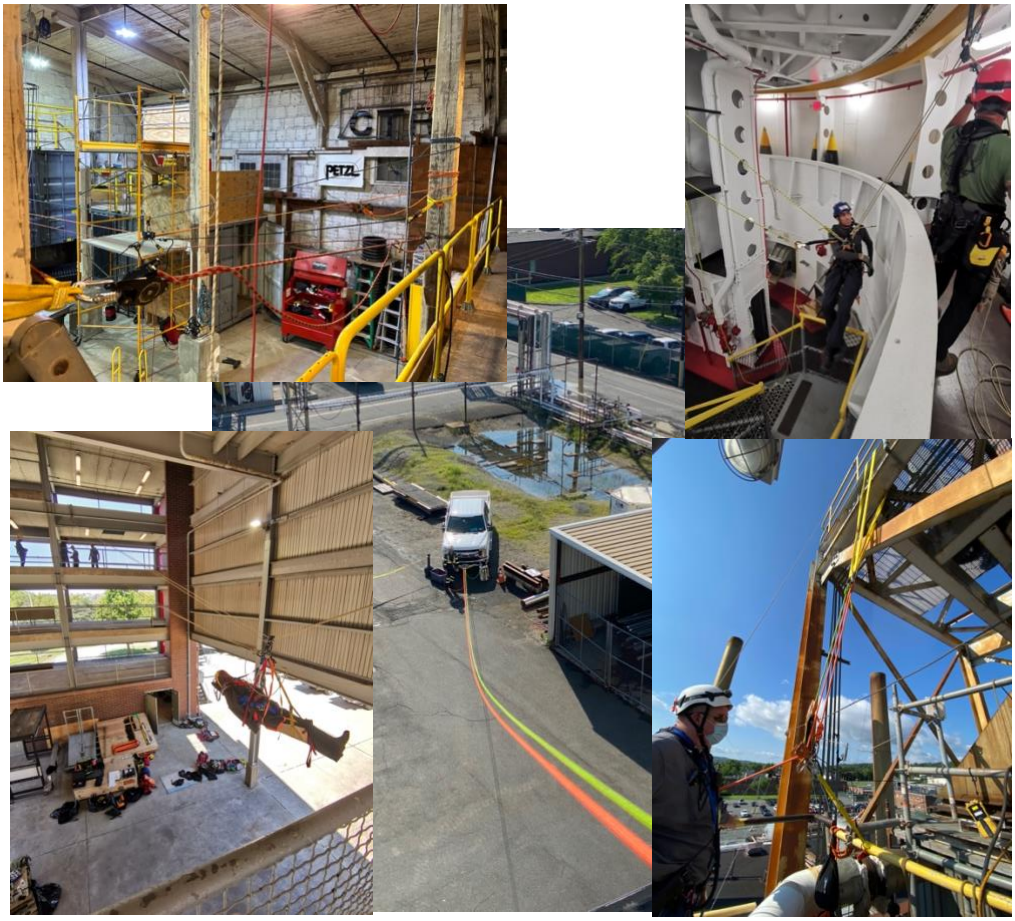
Capital Technical Rescue and Safety Consultants, LLC

Student Manual

Rope Rescue Technician

ITRA Rope Rescue Level 3 Technician



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22 Mill St., Unit 2, Albany, NY 12204 T 518-930-4500 F 518-207-9018 info@capitaltechrescue.com www.capitaltechrescue.com

v2026.10.21

Disclaimer

This manual is intended as a supplement for students who are enrolled or have taken our Rope Rescue courses. The information within is not all encompassing and should never be used without proper instruction from Capital Technical Rescue and Safety Consultants, LLC instructors.

In most instances we do not get into the specific operation, use, limitations, warnings or dangers of pieces of equipment. Even when we do, you should always consult with the latest version of the manual directly from the manufacturer of the product and contact Capital Technical Rescue and Safety Consultants, LLC to receive the proper hands-on training of that device.

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Most of the illustrations in this manual have been created by Capital Technical Rescue and Safety Consultants, LLC utilizing the vRigger software package. Illustrations and diagrams are not to scale. See www.vrigger.com for more details on their software.

For additional information or questions please contact us at info@capitaltechrescue.com or by phone at 518-930-4500.

The latest version of this manual may always be obtained at:

www.capitaltechrescue.com/ropetech-student-manual.pdf

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Pre-Course Information

What to Expect

What to Bring

- PPE
  - Helmet with chinstrap
  - Class III Rescue Harness
  - Long pants / long sleeves or jumpsuits for certain evolutions
  - Good shoes / safety shoes / boots
  - Eye Protection
  - Gloves: Leather / mechanic style
  - Knee pads (optional - rescue classes only)
- Personal Items (optional)
  - Refillable water bottle
  - Snacks / Lunch
- Notify Us
  - Any medical problems
  - Any allergies – food, bees etc.
  - Any concerns you may have
  - If you anticipate arriving late, leaving early, or missing any portion of the scheduled course
- Winter Training – Dress for the elements
  - Our facility only
    - All training is conducted indoors and away from the elements
    - Be prepared to be working in ~ 50°- 60° temperatures

What is provided

- Additional PPE (pre-arrange)
- Coffee
- Water Bottle Fill Station
- Lunch – check with your organizer

Class at our Training Facility

Address

22 Mill Street, Unit 2
Albany, NY 12204

Directions

Directions via Google Maps: https://goo.gl/maps/r2BDuJtPeRR2

Parking

Do not block the gates at the end of the road.

Parking is limited and we try to be good neighbors to a few businesses, so please do not block the dumpster or the loading dock as it is actively used throughout the day.

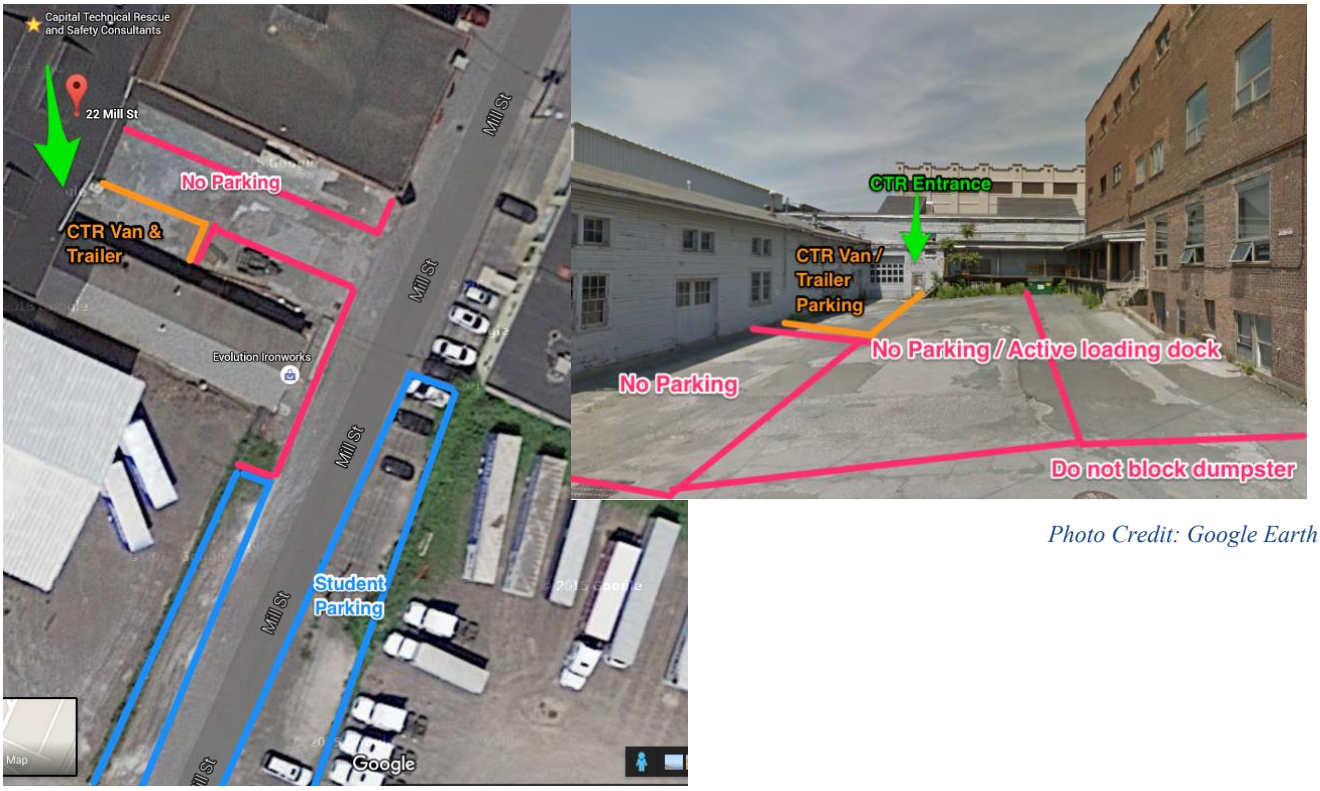


Photo Credit: Google Earth

Photo Credit: Google Earth

Facility Rules

- Tobacco / Vape Free
  - Our facility is 100% Tobacco Free
  - This includes use of smokeless tobacco

Pre-Course Study Material and Information

- Familiarize yourself with:
  - Rope Rescue Operations
    - Covers up to ITRA Technician
    - Covers some of the there are a lower level



Student Manual
Rope Rescue Level 2

NFPA Technician Skills since internationally.

www.capitaltechrescue.com/ropeops-student-manual.pdf

- Read the following sections:
  - Rope Rescue Technician Student Manual
    - Introduction
    - Span Anchors
    - Remotely Establishing Anchors

- Full attendance is required for course completion and full course credit unless missed instruction is completed through CTR-approved makeup instruction.

Introduction

Rope rescue is an ever evolving and changing technical rescue discipline. With its roots deep in the recreational climbing and caving worlds, it has evolved over the years to work and rescue specific equipment and techniques. Many changes have come from various standards organizations throughout the world and have driven various equipment manufacturers to produce amazing gear that continues to get lighter, stronger, and safer to use.

The very basic principles of rope rescue have not changed much, and we still look to always achieve two points of connection in every system we use. This means from the anchor to the load there are always two independent systems, regardless of the equipment and techniques utilized in between.

Environments that teams operate in for rope rescue vary greatly, from back country rescue to urban skyscrapers these basic principles still apply. Rope rescue techniques also find their way into almost every discipline of technical rescue, including trench, confined space, swiftwater, animal, building collapse and more.

This course is designed to address the needs of most teams to perform rescues at the technician level. The NFPA and ITRA have different skills sets requirements for technician, but there are some common ground items. Moving rope along a horizontal path is one of the major items for the highest-level technicians in both standards. Others, such as pickoffs are a basic skill set for a operations or lower level technician in ITRA, however the NFPA sees them as a Technician only skill.

Much of the content in this manual is meant for the Level 3 ITRA Rope Rescue Technician Student and the NFPA Technician Level student, however many of the skills are already in our Rope Rescue Operations manual (link on previous page). Students attending our classes must be familiar with that manual and use this one as a supplement to it.

Regardless of where you work and the territory you respond to, this course is in introduction into technician level rope rescue skills, and is a continuation of your lifelong journey and commitment into becoming a well-rounded technical rescuer. You must realize that like all technical rescue skills, these are perishable, and you must train and practice regularly to be effective and efficient. The recommended training and continuing education sections of this manual will help guide you throughout the course of your journey. Please remember that once you have begun the journey with us, we are always here to help you with any questions or problems you may have. Do not hesitate to send us an email or give us a call whenever you need.

CTR Background

Capital Technical Rescue and Safety Consultants, LLC (CTR) was formed in 2006 to serve the needs of emergency response personnel whose job duties specifically task them with performing a variety of technical rescue disciplines. These responders have come from a variety of agency types including federal and municipal public sector emergency services as well as private industry emergency response teams and fire brigades.

The primary staff of CTR has been working and teaching together for over 10 years, prior to the formation of the company. Their backgrounds vary from volunteer to career firefighters and fire officers, emergency medical technicians to paramedics, and emergency responses from the smallest local incident to natural disasters and terrorist attacks that have had a global impact.

Previous and current CTR contracts have included teaching technical rescue courses from 6 to over 350 students, with scheduled completion ranging from a single day to over the course of several months. This flexibility has allowed our clients to minimize overtime expenses and ensure that production or response is negligibly impacted. This is also true for our industrial clients and has led us to be one of the most experienced groups of standby rescuers.

Capital Technical Rescue and Safety Consultants, LLC is a proud Petzl Technical Partner (PTP).

What is a Petzl Technical Partner (PTP)?
A PTP is a recognized expert company or individual in a vertical environment that demonstrates a thorough understanding of their respective industry, contributes to the development of best practices, and meaningfully integrates Petzl into their systems and curriculum. In return for this promotional support, Petzl endeavors to share our information, our products, our time, and our resources to ensure mutual success and sustainable growth.

Who is a Petzl Technical Partner?

Trainers & Training Organizations
Industry Leaders & Influencers
Consultants & Field Experts

PTP Mission Statement:
The Petzl Technical Partner (PTP) Program's mission is to develop a diverse network of training company partners and recognized leaders who can help Petzl promote our products and solutions to a wide variety of industries and end-users. Whereas Petzl is an expert in our products and services, we believe that front line, subject-matter experts are the best bridge to the industries we ultimately serve.
As a Petzl Technical Partner, we are part of a network of subject matter experts. There are technical partners located in 5 continents and in over 18 countries.

Capital Technical Rescue and Safety Consultants, LLC serves clients from a variety of industries. These include:

Food Service
- Ingredient Facilities
- Food processing and packaging

Paper Mills
- Fine Papers
- Recycled Paper
- Tissue Paper

Nuclear Facilities
- Nuclear research
- Nuclear training facilities

Chemical Plants
- Silicones
- Formaldehyde
- Methanol
- Pharmaceutical research and development
- Pharmaceutical production
- Biotechnology research and development, production

Industrial Plants
- Nanotechnology production
- Nanotechnology research and development
- Packaging production
- Personal Protective Equipment manufacturing
- Armament Production

Mining Operations
Cement Plants
Research Facilities
Environmental Services
Power Generation – Hydroelectric, Coal
Fire Academies
Municipal Services
Airports
Construction

CTR has a warehouse full of rescue equipment, including multiple rescue boats. Depending on the needs of the client and our hazard surveys will depend on what equipment is required. Typical CTR Confined Space Rescue Equipment list:

Atmospheric Monitors, RAE Systems	Ventilation Fan (for actual emergencies only)
Rescue Rope, variety of lengths	Supplied Air Systems (SAR) and SCBA
Mechanical Advantage Rope Systems	Pulley systems
Anchor straps	Rope winch system
Tripods, bipods and monopods	Fall arrest rescue equipment
Patient packaging gear, SKED, SPEC PAK	Intrinsically safe radios and lighting
Edge protection	Reference material, iPads, onsite phone
Ascenders & Descenders	Additional hardware and software as needed

In addition to the rescue equipment, we have our own indoor training facility for rope and confined space rescue. Our props are utilized in clients' courses as well as in testing out new and prototype equipment and techniques as well as keeping our staff up to date.

The confined space rescue simulator has multiple levels, opening types, dimensions and space configurations. These include both vertical and horizontal access points, vessels with bottom openings, top openings and more. The simulator is also located in doors and allows us to train throughout the year, regardless of weather conditions.
We are also located just minutes away from the Hudson River and the Corning Preserve boat launch. This allows us to get out on the water and train, test new equipment and get it all back in service quickly.

There are also various other training props, including cell towers, firefighter survival, and lock out tag out in house. Our warehouse area stages equipment we utilize for HAZ-MAT, trench and collapse rescue courses, as well as rigging equipment for heavy duty operations.

As this space continues to evolve, we imagine many more possibilities. These include the capability to evaluate client's issue on site and re-create it in house, so we can practice performing a potentially difficult rescue within a safe area.

You can learn more about our site at the following links:
https://www.capitaltechrescue.com/post/indoor-training-facility

https://www.firehouse.com/rescue/article/12146756/technical-rescue-training-facility-profile-capital-technical-rescue-safety

Standards

National Fire Protection Association (NFPA)

1006 - Standard for Technical Rescue Personnel Professional Qualifications

This standard identifies the minimum job performance requirements (JPRs) for fire service and other emergency response personnel who perform technical rescue operations. We utilize this standard to ensure that our training programs provide you with the knowledge and skills to meet current national standards. This standard applies directly to you, the individual rescuer.

1670 - Standard on Operations and Training for Technical Search and Rescue Incidents

This standard identifies and establishes levels of functional capability for efficiently and effectively conducting operations at technical search and rescue incidents while minimizing threats to rescuers. It is intended to help the authority having jurisdiction (AHJ) assess a technical search and rescue hazard within the response area, identify the level of operational capability, and establish operational criteria. This is known as an "organizational" standard and specifies what your organization should do and know for technical rescue incidents.

1983 - Standard on Life Safety Rope and Equipment for Emergency Services

This standard specifies requirements for life safety rope and associated equipment used to support emergency services personnel and civilians during rescue, firefighting, or other emergency operations, or during training. It is imperative to understand that this is not a "use" standard. This standard is known as a "manufacturers standard" as it defines how equipment should be made, tested, labeled and documented. Within NFPA 1983 come the terms "General Use" and "Technical Use" which relate to ratings of the specific equipment.

1858 - Standard on Selection, Care, and Maintenance of Life Safety Rope and Equipment for Emergency Services

NFPA 1858 is written for organizations that evaluate the risks faced by emergency responders and their particular needs for life safety rope and equipment. It is also written for users of life safety rope and equipment to enable them to inspect, maintain, and care for the life safety rope and equipment they use during rescue and training operations that is compliant with NFPA 1983, *Standard on Life Safety Rope and Equipment for Emergency Services*.

NFPA 1858 applies to life safety rope, escape rope, fire escape rope, fire escape webbing, escape webbing, throwlines, moderate elongation laid lifesaving rope, life safety harnesses, belts, auxiliary equipment, litters, and victim extrication devices certified as compliant with NFPA 1983.

2500 - Standards for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services

This standard is a combination of NFPA 1670, 1983 and 1858, and was first released in 2022.

International Technical Rescue Association (ITRA)

About ITRA

The International Technical Rescue Association is a non-profit trade association, established by technical rescue practitioners for technical rescue practitioners. We exist to provide global recognition of technical rescue practitioners including instructors. We have developed a global syllabus to compliment national standards, allowing local flexibility with global recognition.

ITRA currently has approved and deployed curricula for the following rescue disciplines:

- Rope
- Swiftwater
- Boat
- Confined Space

CTR encourages students to take our ITRA courses and to become active members of ITRA.

As a member of ITRA you become part of a collaborative and supportive worldwide trade association that can provide instruction and assessment against global certifications across a range of disciplines and levels. It demonstrates that you are committed to excellence and high standards set by our Code of Conduct, providing external credibility and accountability.

Membership also provides opportunities to be involved in a range of association projects, from governance on the Board, to serving on committees and working groups.
We also envision numerous national and international opportunities from exchanges and conferences becoming part of the future too.

ITRA is now governed by a Board of Directors who were elected by the ITRA membership and who serve three-year terms. Previously, an interim Steering Committee was established to stand up the association and provided initial governance.

CTR has ITRA certified instructors, which means that they have been assessed in both skill and knowledge and have actually performed each of those skill sets to the ITRA standards. These are not just course attendance certificates and ITRA instructors and students can be verified for their current qualifications in the ITRA directory.

To find out more about ITRA or to become a member check out the ITRA Website

PURPOSE: WHY ITRA?

- To promote international best practices and standards for technical rescue.
- To improve the global portability and recognition of professional rescue qualifications.
- To provide local flexibility in delivering technical rescue training curriculum.

VISION, MISSION & VALUES

VISION : Our Hope

- A collaborative and professional global technical rescue industry.

MISSION : What we do

A. Recognize and document locally delivered training according to global best practice.
B. Provide Independent competency-based assessment for instructor and technical rescuers.
C. Maintain a global central database of training records for members.
D. Share safety related lessons learned from technical rescue activities to prevent harm.

VALUES : How we do it

Accountability:

1. Training and assessment systems developed by industry for industry.
2. A non-profit entity that is driven by and accountable to its membership.
3. Instructors and Practitioners maintain their currency through robust re-certification process.
4. Members acting professional and accountable under a Code of Conduct.

Transparency:

1. Meaningful and genuine consultation with members on our work.
2. Active use of social media to engage and keep members informed.
3. Annual disclosure of our activities and finances to our members.
4. Public register of qualified practitioners, instructors and assessors.

Working together:

1. To share knowledge, skills, and experiences across all disciplines of technical rescue.
2. Establish an international reporting system to highlight safety concerns within the industry.
3. To review and enhance rescue and rescue related training and assessment standards.
4. To foster collaborative interaction and professional development within the industry.
5. Membership adds value to individuals and organizations.

Legal Status

The International Technical Rescue Association is a non-profit corporation, registered in the state of Pennsylvania, USA.

Advanced Anchoring Systems

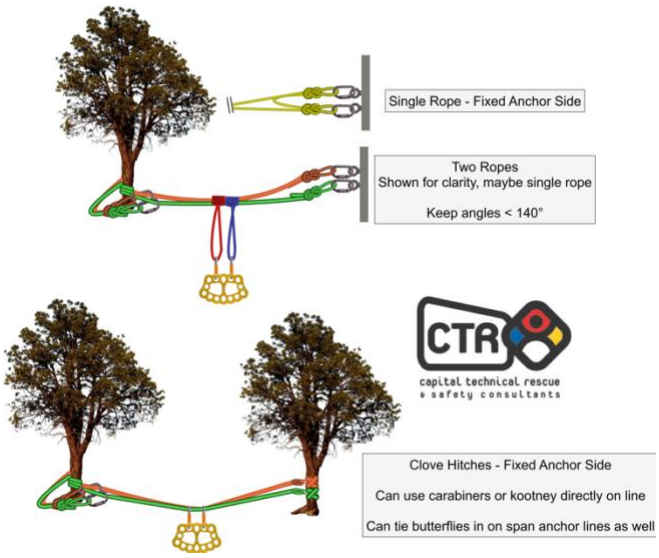
Span Anchors

Span Anchor

Not to be confused with Twin Tensioned Rope System, as this is not a "working" system. The intent is to create an anchor point where one does not exist.

Span anchors maybe used for horizontal or vertical anchoring. Could be used in a low anchor, or over an embankment where anchors are sparse.

System can be either "tensioned" with a M:A system, or just have redundant tie offs on either anchor. When not tensioning the system through a device that allows for slippage, it is recommended for the anchor lines to not exceed 140°.



- Best Practices
  - Independent connection points
  - Anchor to anchor plate (2)
  - Anchor to Terminal Knots
  - Use as much of a single rope as possible
  - Two F8 on bight with jumpers

- Consider the forces
  - Anchor lines are creating vector forces of 150° & up possibly
  - The higher the anchor (for overhead systems) and the more sag you have the less forces will be on the anchors
    - Setup at least 8’ - 9’ off ground minimum
    - Expect up to 24” of sag when loading vertically
  - The more sag you have the less forces will be on the anchors - try to keep under 140° if possible
  - 150° to 175° forces may increase from 2 – 11 times the load at each anchor

- Attaching to a Span Anchor
  - Triple Wrap Basket Hitch (sewn prusik)

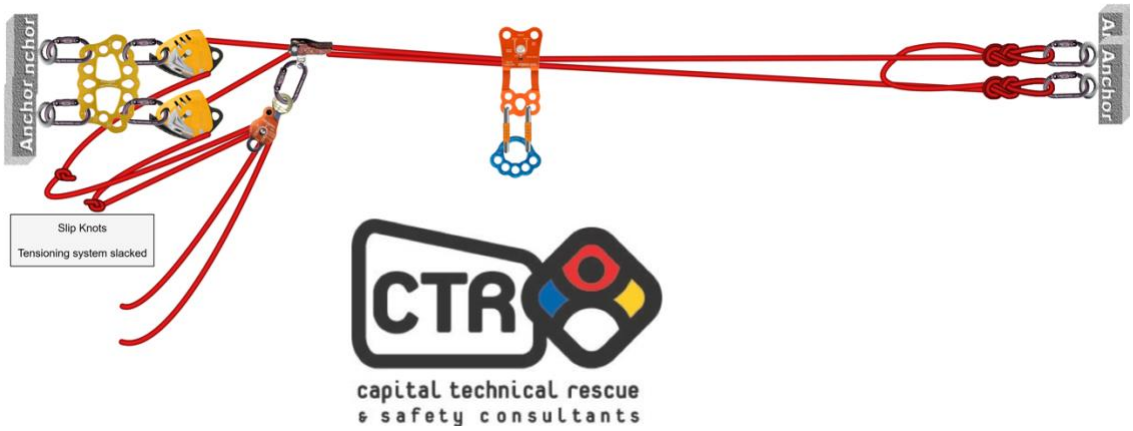
- Carabiners
- Pulleys
  - Single
  - Kootney

Tensioned Span Anchors

Typically we tension span anchors when they are used overhead, or there is very little room to the edge, and we need minimal sag, and have bombproof anchors on either side.

- Tensioning
  - Utilize a Maestro, Clutch or MPD for best efficiency when tensioning system
  - Only tension as much as needed.
  - If using a 15:1, no more than 2 haulers pulling 2 – 3 times max
  - On average – 2 – 2.5 kN of force on each of the legs of the twin anchor (up to double at each anchor)

- Best Practice
  - Slack the M:A system before loading / using the tensioned twin anchor system
  - Consider tying slip knots in the ropes about 6’ – 8’ away from anchor descenders.



Remotely Establishing Rope Systems

Throw Bag

Lightweight throw bags designed for use by arborists to get a pilot line up in a tree can also be used for rescuers to establish a high point remotely in a tower, or across a short span they can throw the bag. Typically, these bags may weigh from 8 – 16oz and have a lightweight throwline attached. This throwline is approximately 2mm in diameter with various lengths available. The throwline is best stored in a cube or bag designed for throwline to ensure it pays out properly when thrown.



Photo Credit: Sherrill Tree Stock Photos

Big Shot

The Big Shot is a giant sling shot, that allows you to easily launch a throw bag accurately a greater distance.

Line Launchers

There are a variety of line launchers on the market, with some being actual firearms, that send a projectile with a line attached to it towards the target area. Others are powered by compressed air, which are typically not as accurate and have a heavier and larger projectile. We do not normally recommend these for rescue use, even though they are marketed towards our industry.



Photo Credit: Rock N Rescue Stock Photos

Drones

The first step in understanding how to use drones to establish a pilot line, is that regardless of the weight of the drone, the fact that it is being used for "work", career or volunteer, public safety uses automatically require that pilots be compliant with FAA Part 107 rules.

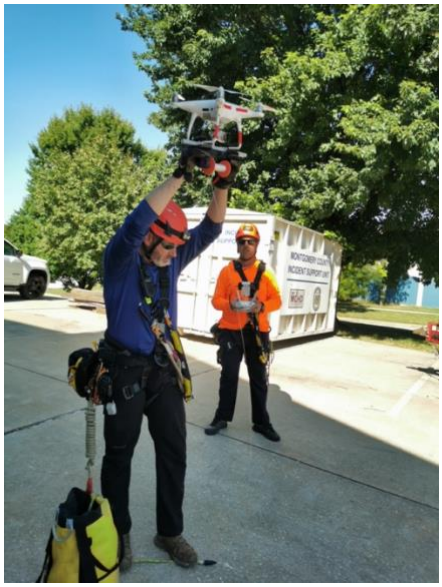


Photo Credit: Highnovate, VRDC System

There are many types of drones on the market, all with varying ability. Carrying a line on a drone may require disabling some of the collision avoidance sensors, landing safety features and other features that a newer pilot may still be relying on. Training and selection of pilots, aircraft and payload systems must be thoroughly researched.

Videos:

Throwline 101: Basic Technique
By: Educated Climber

Big Shot Throw Weight Launching
By: SherrillTree

BigLauncher / Lucky Launcher
By: SherrillTree

Drone Passing a Rope in A Canyon
By: Highnovate

Never fly a payload you cannot release from the aircraft remotely.

Remember, Takeoffs are optional….landings are mandatory!

For more information and training on piloting drones and their use in technical rescue, hazardous materials, firefighting and water rescue, email us: info@capitaltechrescue.com

Horizontal Rope Rescue Systems

Horizontal Deflection Systems

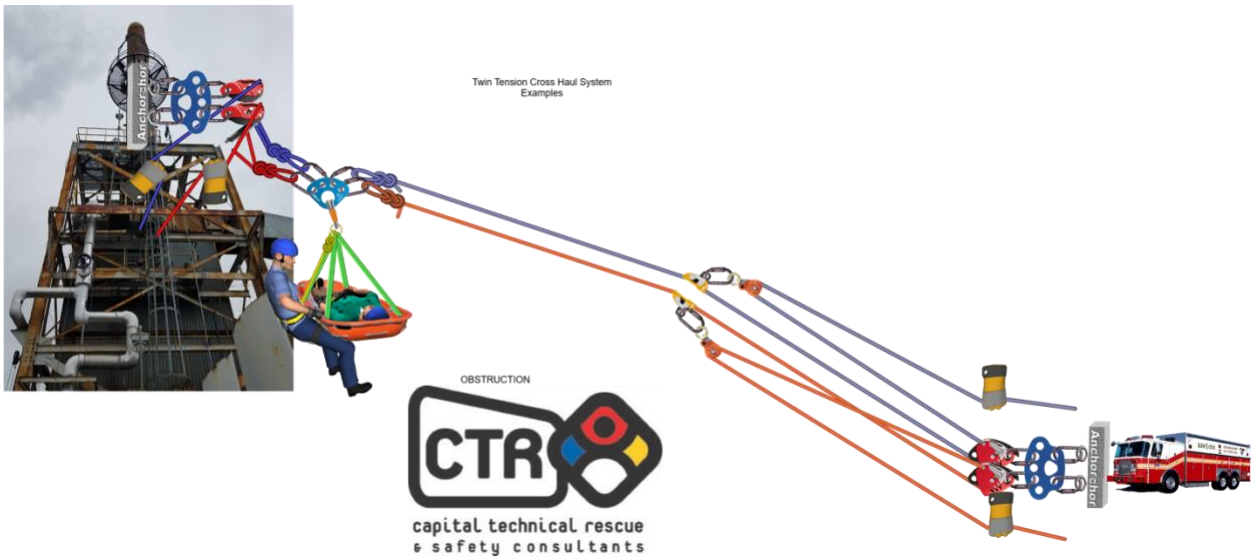
Cross Haul

AKA Two Rope Offset, AKA Opposing System

A crosshaul is two full sets of main & belay anchors and systems, so that the load ends up with 4 ropes attached to it.

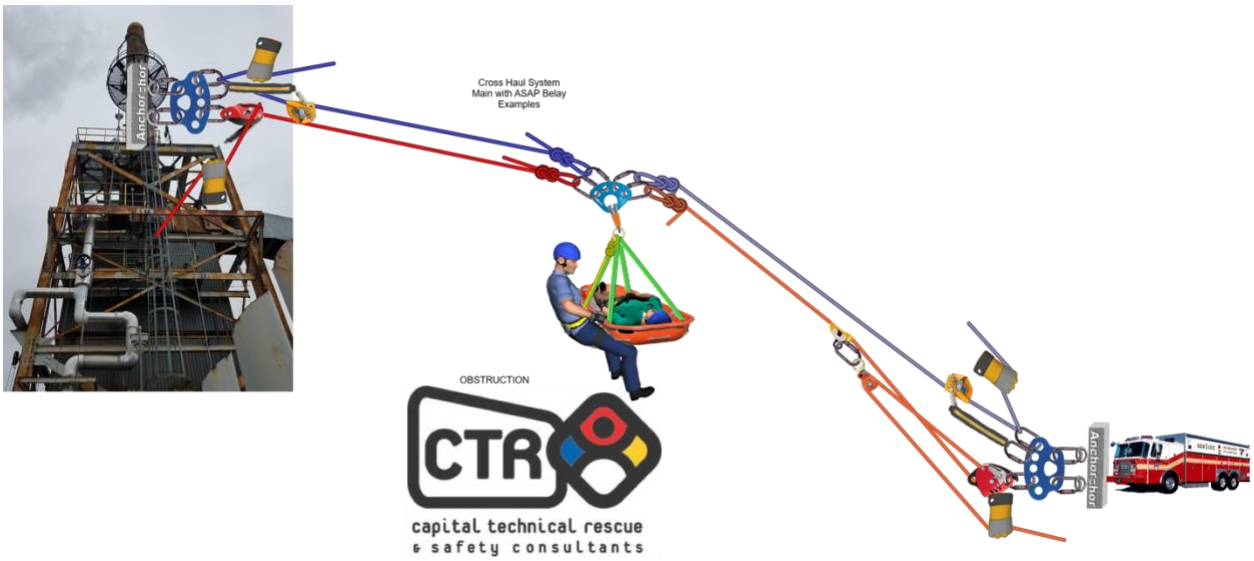
This system requires good communication between each system and is also a good team building exercise. They can be used anywhere there is a wide area to be traversed whether it is in the wilderness or industrial settings.

Once each side has a main and belay anchor and system built, attach to the load. If the load is a litter bridle, then all ropes may go to the master access point (MAP) as long as that is one solid piece. If attaching to a rescuer, then both of the "main" lines should be attached to the same point on the rescuers harness (ventral attachment for both near and far side main line), while both of the belays get attached to another point on the rescuers harness (sternal attachment for both



near and far side belay line).

Typically will use a 3:1 or 5:1 M:A system on one side, which keeps tension / hauls as the other side lowers. If the haul team is hauling too fast or the lowering system isn't keeping up then the haul team will be putting unnecessary stress into the system.



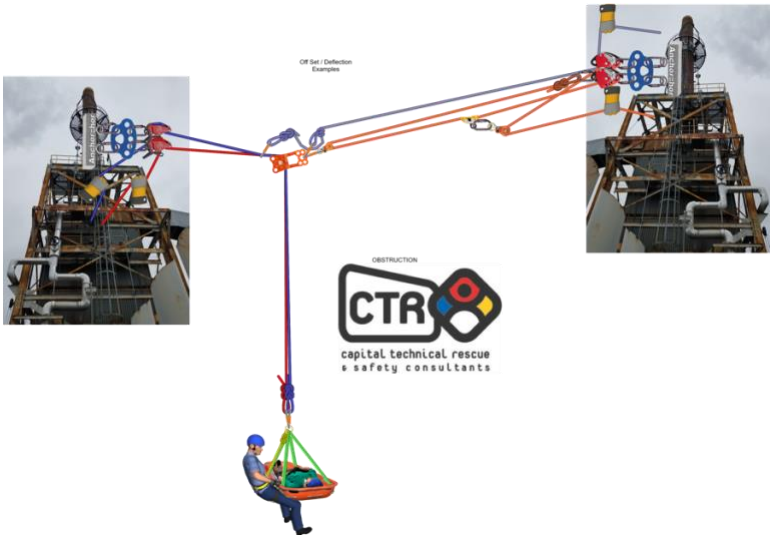
A 3rd set of main / belay could also be introduced into the system so that the system becomes 3 dimensional to move a load through a certain path avoiding obstacles along the way.

Deflections / Offsets

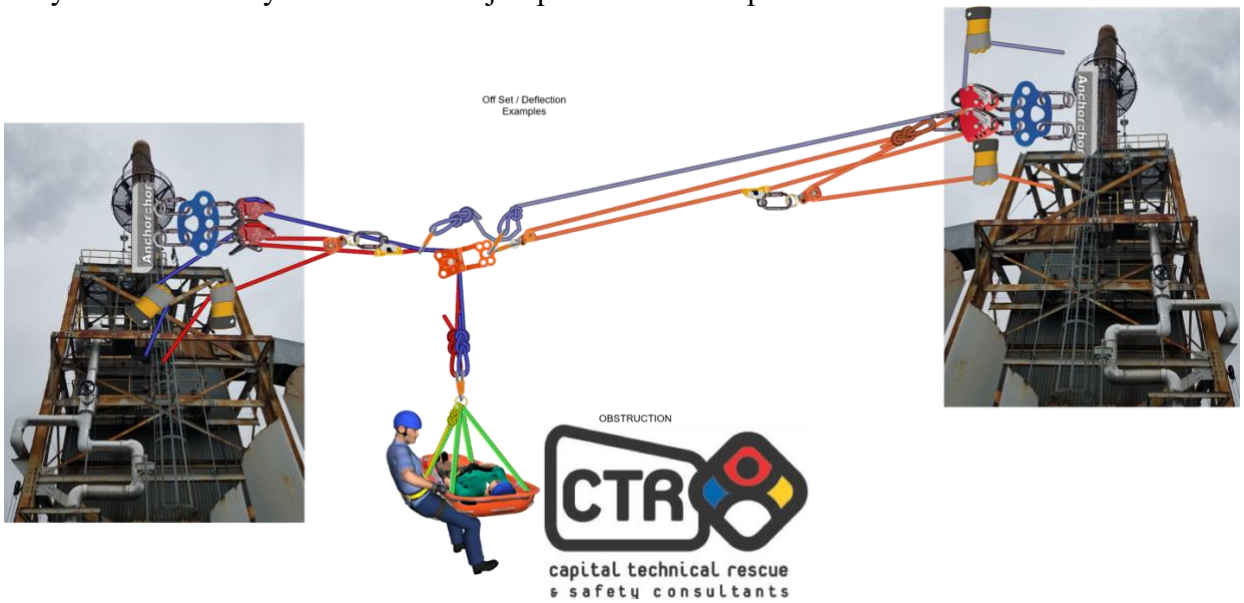
Also called a deflected line, dynamic directional or simply "pull away"

Can be like a cross haul with the only difference is a deflection pulley attached to the hauling side of the system, to "pull away" (deflect) the main and belay line for a raising and lowering system.

This deflection creates a new fall line for the rescue load and the main and belay lines should only be deflected enough to avoid obstacles as needed.



The deflection systems should have two points of contact to include the pulley and the main / belay lines. This maybe done with a "jumper" attachment point.



Either two single swivel pulleys can be used on the deflection line, or a Kootney style pulley.

Guiding Lines – Vertical Support

A guiding line is a single line that pulls a two rope rescue system away from a structure or obstacle slightly.

In this scenario the load will be primarily on the two rope system.

The guiding line should only be "tensioned" enough to clear the obstacle, so that if the guiding line were to fail there would be a minimal swing of the rescue package.

The guiding line should be able to have tension or slack introduced into it quickly.



Guiding Lines – Horizontal Support

A horizontal guiding line is one where the load will be primarily on the guiding line and we minimize the hazard by keeping the rescue package just off the surface of the terrain. Therefore a second line is not needed, like there would be in a high line. A Set of Fours or other adjustable method maybe used to bring the rescue package either closer to the surface or closer to the guiding line.

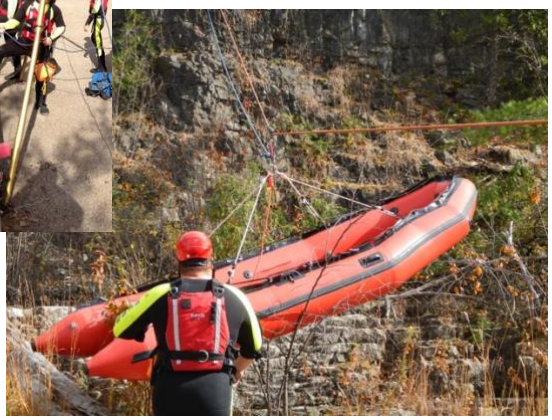
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The rescue package will still be moved / lowered using a two rope system. In the above example the rescuer is primarily able to walk with a victim across an area with uneven and poor footing and adjust the victim up or down as needed to deal with the terrain.



Guiding line used to lower and raise boat down embankment.



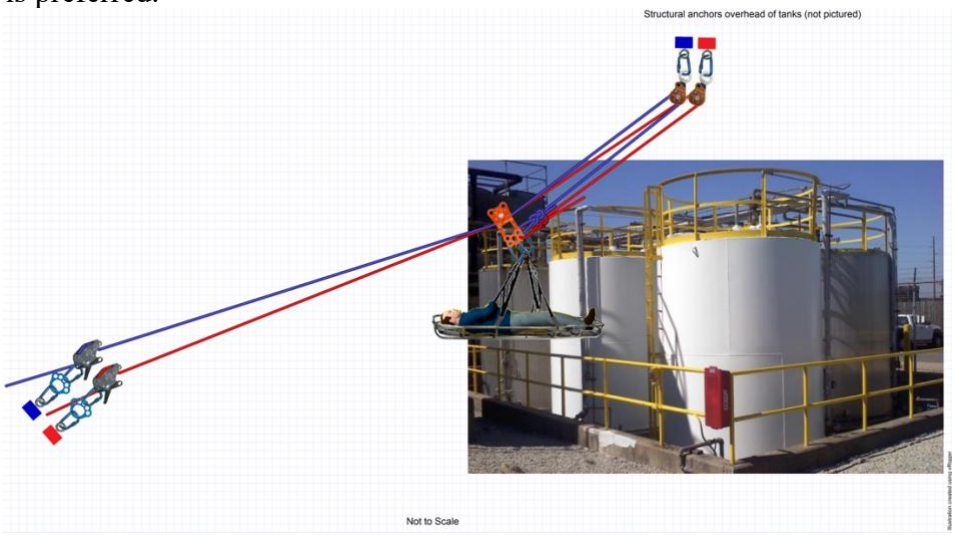
Skate Blocks

Skate Block Overview

A skate block is a ground based lowering technique, where raising and lowering happens at the ground and only a change of direction is required at the high point. The rope coming out through the change of direction at the high point then attaches to the load, and the load is also attached to

the rope coming into the change of direction with another pulley. This creates the "skate" that occurs after the rope is put through the "block" or change of direction pulley.

Belay can be used as ground based, but also can still be run direct from the top. The issue with doing this with a skate block is that swinging is a hazard if main line failure occurs, so the twin skate block is preferred.



Skate Blocks require about 70' more rope than twice the height of the structure.

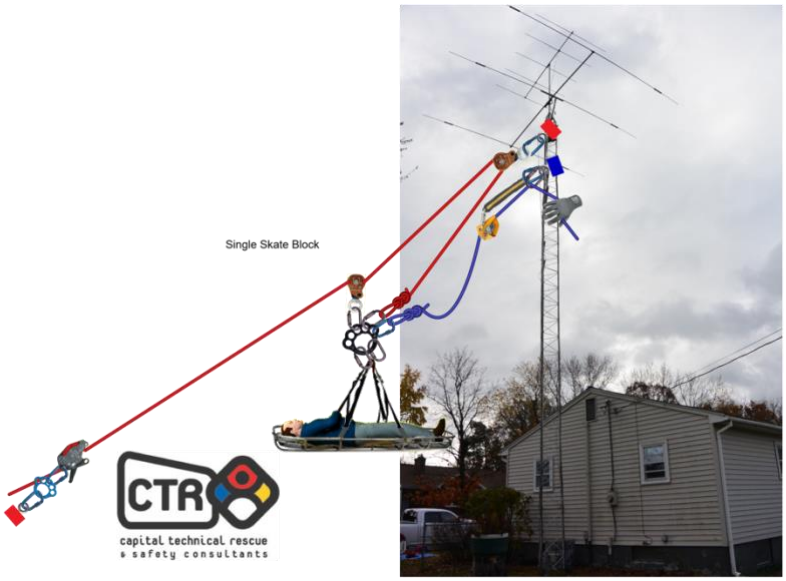
Common Skate Block Variables:

Height of structure / anchor
Horizontal distance from structure to ground anchor
Weight / load being raised or lowered
Rope Stretch

All these factors tell us that typically the load will travel away from the structure between the distance from the structure to the ground anchor when being lowered.

Single Skate Block

The main line is the only system setup in a Skate Block configuration, with belay done from the top of the structure. The down side is if skate line fails there is likely to be a swing back towards the structure.



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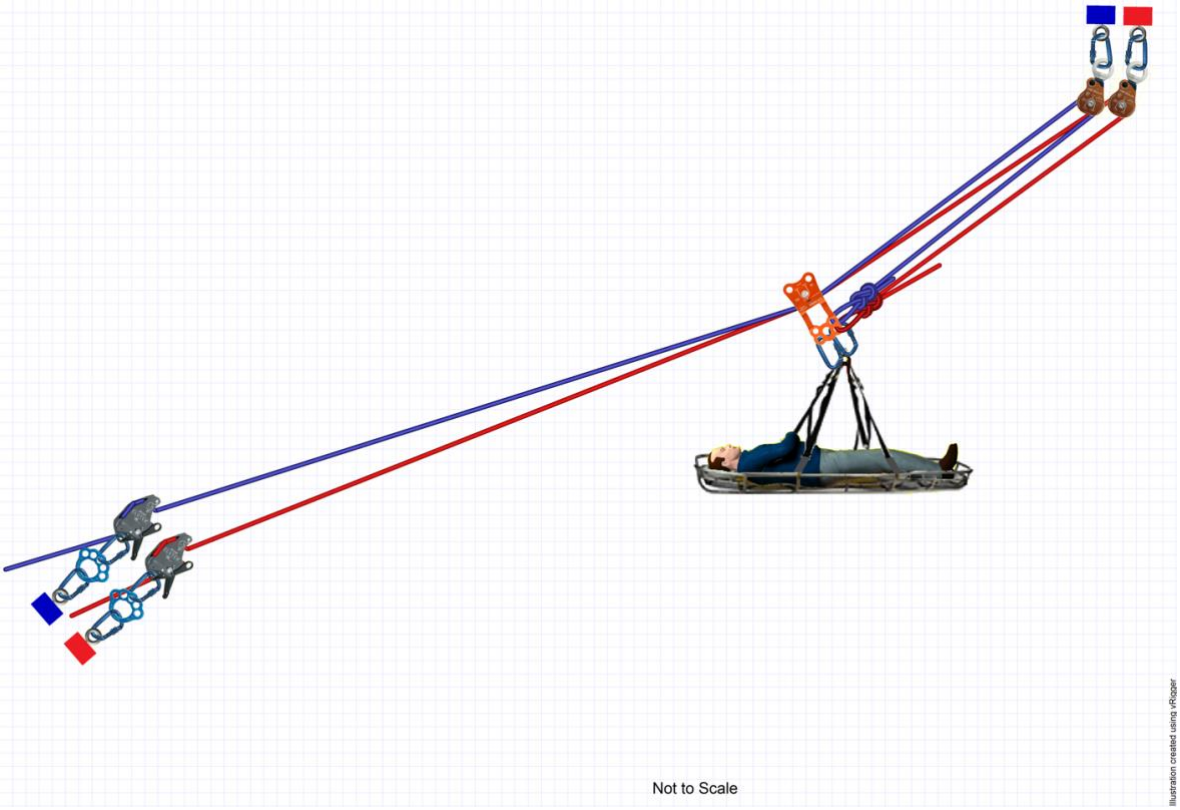
Mirrored Skate Block

Traditional two line skate block

Ground based lower, with two changes of direction at high point, back to the load.

When attached to a rescuer or victim harness it will ride better if there is a single attachment point to the harness. ie. both lines to the sternal or both lines to the ventral.

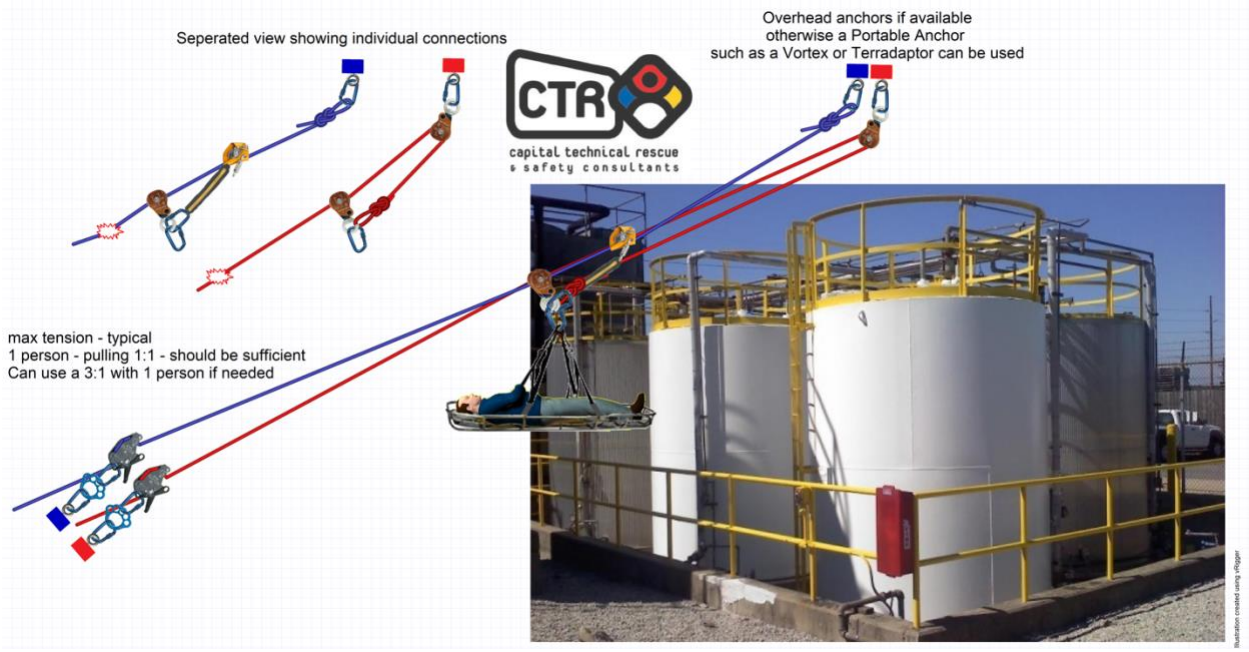
Typically works best with two single swivel pulleys as opposed to a double pulley or even a kootenay.



Hybrid Skate Block

The hybrid system uses a single skate block line coupled with a low-tension track line. Typically, only tensioned by a single person, it is initially tensioned just enough to take out the slack. If more tension is needed to skate the load away, then one person hauling on a 3:1 MA system can be used.

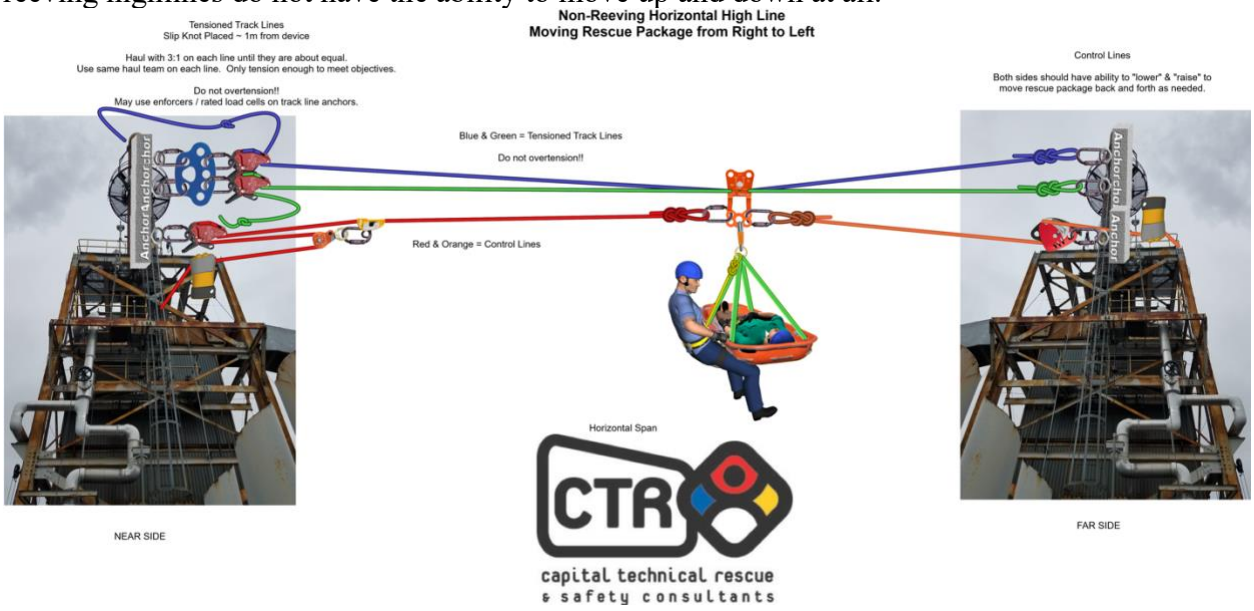
Often we terminate the tracking line to the high point for simplicity, however should a main line failure occur, it is possible that you would need to break into a tight line in order to lower the load safely. A better solution, should enough rope be available is "rig for rescue" and also put a DCD at the top of the tracking line with additional rope so you can lower from the top side if needed as well.



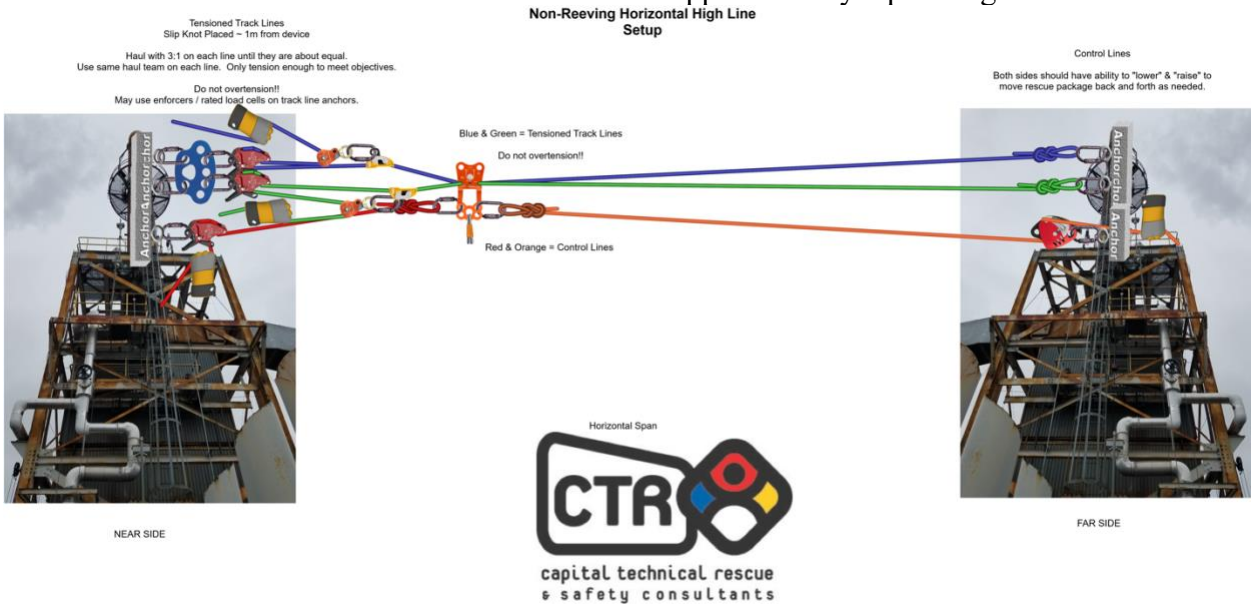
Track Line Based Systems

Horizontal Highline – Non-Reeving

Allows us to move horizontally in either direction to cross an obstacle or open span. Non-reeving highlines do not have the ability to move up and down at all.



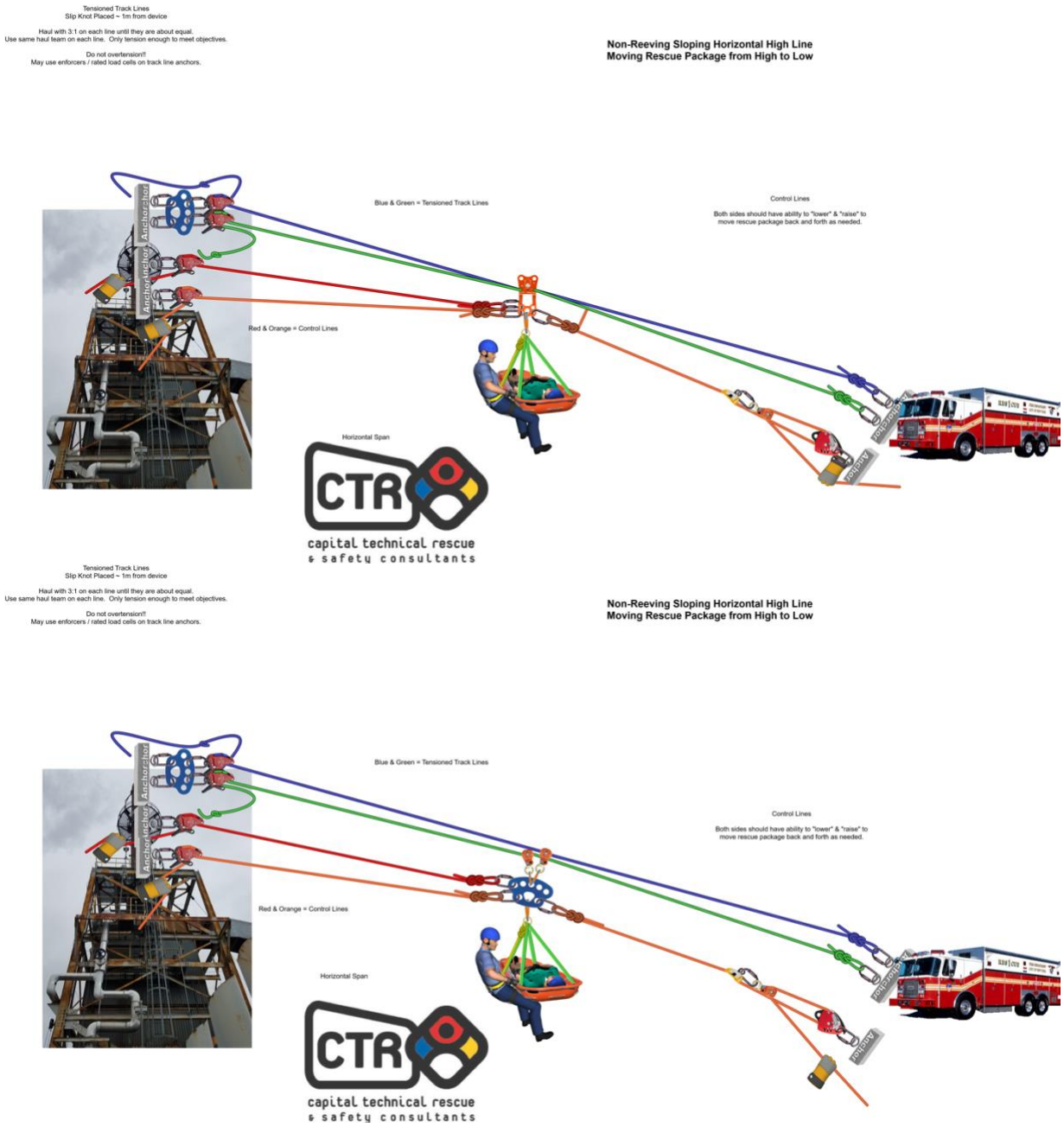
Two track lines will be established and tensioned at approximately equal heights and tensions.



One control line on either side of the carriage.

Sloping Highline

Two track lines will be established and tensioned to unequal height structures.
Main & Belay Control lines to lower / raise on top side. A single control line maybe utilized on the lowest height structure side. In the below examples, the only difference is the use of a Kootney pulley versus two single pulleys with an anchor plate.



Recommended Training / Continuing Education

Technical rescue, regardless of the discipline, is a perishable skill set. Without regular and consistent training, the skills taught will diminish to a point that could be harmful to yourself and

your team members. This includes but is not limited to severe injuries or death due to human errors in not operating or rigging equipment properly.

We can assist in any of these skills sets, and have clients who we work with monthly, quarterly and annually to ensure they stay sharp on their skill sets.

Weekly

Recommended Minimum Time Commitment: 1 Hour

It is recommended that team members practice some type of skill at least weekly. This can be a self-guided focused review or lead by a team member who has proficiency in that particular skill.

Example topics:

- Knots
- Donning Harnesses
- Patient Packaging
- New Equipment Review
- Raising and Lowering Setups
- Equipment Inspections

Monthly

Recommended Minimum Time Commitment: 1 - 4 Hours

It is recommended that team members meet and practice some type of skill at least monthly. This can be a self-guided focused review or lead by a team member who has proficiency in that skill.

Example topics:

- Knots
- Patient Packaging
- Raising and Lowering Setups
- Mechanical Advantage
- Belaying
- Pre-Planning
- Equipment Inspections

Monthly training may take place at your location or CTR's indoor training facility in Albany, NY.

Quarterly

Recommended Minimum Time Commitment: 4 Hours

It is recommended that team members meet and practice some type of simple rescue scenario at least quarterly. This should not be too complicated of a scenario but rather focus on overall team dynamics and putting together all the topics they have worked on over the past few monthly drills.

These scenarios can be guided by CTR or a team member who has shown proficiency in all systems the team uses. These should be low risk scenarios that have been pre-planned and well thought out by the team member to ensure that no one can get hurt during training.

Quarterly training may take place at your location or CTR's indoor training facility in Albany, NY.

Annual

Recommended Minimum Time Commitment: 8 - 24 Hours

Annual training is not only a great time for refresher training but also to introduce new equipment, techniques and advancements. The minimum time is typically 8 hours, however if your team does not partake in weekly, monthly and/or quarterly training than you may need up to 24 hours of refresher training.

We recommend that you bring in a trainer such as CTR to perform this refresher training. This will allow for an independent evaluation of your team as well as ensuring that the latest techniques and/or equipment can be taught.

Our most popular option for teams that train is for a 16-hour refresher annually. This allows for time to review equipment and techniques and introduce new techniques and equipment, while still allowing plenty of time for OSHA and NFPA recommended scenarios.

Example topics:

- Knot Review
- Equipment Review
- New Equipment
- New Techniques
- Simple and more complicated scenarios

Annual training may take place at your location or CTR's indoor training facility in Albany, NY.

Other recommended training courses available

CTR has many other training courses and topics that may interest you and / or your team depending on your needs. See our website for the most up to date information. www.capitaltechrescue.com

- Emergency Response Team Training
  - Team Evaluations
  - Site-Specific Rescue Operations
  - Stop the Bleed / Trauma Response
  - Fire Extinguisher Training
  - Structural and Industrial Live Fire Training
  - Rescue from fall protection

- Rope Rescue
  - Operations
  - Technician
  - Refresher
  - Artificial High Directional
  - Lead Climbing
  - Tower Rescue

- Industrial Escape Systems

- Confined Space
  - Entry
  - Awareness
  - Operations (non-IDLH)
  - Operations (IDLH)
  - Technician
  - Rigging Challenges
  - Small Team Operations

- sUAS (Drones)

- Water Rescue
  - Rescue Boat Operator for OSHA 1926.106
  - Ice Rescue
  - Swiftwater Rescue

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Advanced Classes and Clinics

These are all topics covered in advanced classes that we offer. Contact us for more information

Advanced rigging / small team intro

Tie Backs

Focused Anchors

Removable Anchors

- Removable Bolts
- Beam Clamps
- Pull Through Anchors

Split 4:1

Batwing 6:1

Capstan / Harken winches

Crane rigging

Monopods / bipods

Body Weight Anchors

Twin tension anchor systems

Ground Based Lowers

Small Team Clinics

Rescues Gone Wrong Clinic

Rigging Challenges

Skate Blocks, Hybrid Skate Blocks, Offsets & Crosshauls

Tower Rescue

Reeving & Non-Reeving Highlines

Efficient Rescue Operations Clinic

Definitions

This section provides standardized terminology used throughout rope rescue operations. Definitions are drawn from Capital Technical Rescue's curriculum, NFPA standards (1006, 1983, 1670, 1858), SPRAT guidelines, ITRA syllabi, and industry best practices. Where applicable, references are included.

MBS (Minimum Breaking Strength)

The lowest force at which a component will fail under load. Often de-rated based on configuration (e.g., knots, tri-loading).
Example: A rope with 40kN MBS may be de-rated to 20kN when knotted.

Span Anchor

An anchor system that spans between two fixed points to create a usable anchor where none exists. Can be tensioned or non-tensioned depending on application.

Skate Block

A ground-based lowering system using a change-of-direction pulley at the high point. The rope is routed through the pulley and back to the load, allowing horizontal movement during vertical descent.

Pickoff

A rescue technique where a rescuer descends to a victim and transfers them to a rescue system for evacuation.

Highline

A rope rescue system designed to move a load horizontally across a span, such as a canyon, river, or industrial void. It typically consists of one or more tensioned track lines and a carriage that supports the load. Highlines may be:

Non-Reeving: The load can only move horizontally; vertical movement is not possible.

Reeving: The system allows both horizontal and vertical movement of the load, often using pulleys or reeving blocks.

Sloping Highline: A variation where the track lines are tensioned between points of unequal height, allowing controlled descent or ascent.

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Guiding Line

A rope used to guide a rescue load horizontally or vertically to avoid obstacles or terrain. Can be tensioned to provide support or directional
control.

Carriage

The component (often a pulley or pulley system) that rides along the track line in a highline system and supports the load.

Hybrid Skate Block

A combination of a single skate block and a low-tension track line. The track line provides lateral control or support, while the skate block handles vertical movement. This setup allows for better control of the load path and can be rigged for rescue with a descent control device (DCD) at the high point.

Guiding Line (Vertical vs. Horizontal)

Vertical Support: Used to pull the load slightly away from a structure or obstacle. The guiding line is tensioned just enough to clear the hazard and should not bear the primary load.

Horizontal Support: Used to support the load across uneven terrain. The guiding line bears most of the load, allowing the rescuer to walk the victim across while adjusting height as needed.

Cross Haul (Two Rope Offset)

A horizontal movement system using two complete main and belay systems on either side of a span. The load is attached to all four lines and moved by coordinating haul and lower operations from each side.

Deflection / Offset System

A directional system where a pulley is used to deflect the main and belay lines away from their natural fall line to avoid obstacles. This creates a new vector path for the load.

Track Line

A tensioned rope used in highline systems to support and move a load horizontally. Can be used in both non-reeving and sloping highlines.

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Control Line

A rope used to move a load horizontally along a highline or track line. In non-reeving highlines, there are typically two control lines—one on each side of the carriage—to allow bidirectional movement. In sloping highlines, a single control line may be used on the lower side to assist with descent.

Non-Reeving Highlines

A fixed-span system where the load is suspended from a carriage that moves horizontally but cannot be raised or lowered. Movement is controlled by control lines on either side.

Reeving Highlines

A more complex system that allows both horizontal and vertical movement of the load. It includes a reeving system (typically a pulley or block) that enables raising or lowering from the highline itself.

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Appendix

Appendix A - Factors of Safety

Factors of Safety, By Cliff Freer

Glossary of Terms

DCD - Descent Control Device

De-Rating - The act of reducing the MBS of a piece of equipment when it is not used in accordance with its intended design. (rope to 50% after knotting, carabiners to 50% for tri-loading, carabiners to 75% for wide or excessive webbing)

Dynamic System Safety Factor – The force of the Maximum Anticipated Load divided into the piece of equipment with the lowest MBS in the system.

Load Limiters - Stacked and stitched webbing intended to deploy at predictable loads to absorb and limit the energy transferred to the people using the equipment.
(Petzl ASAP Sorber Axess, Yates Rescue Load Limiter)

Maximum Anticipated Load - Estimated at 6kN based on the absorbing force of the ASAP with energy absorbing lanyard and published slip-testing data of DCDs.

MBS - Minimum Breaking Strength

Proof Loading/Testing - A load test performed by some manufacturers testing individual pieces of equipment before releasing the equipment for use. One-quarter of the MBS appears to be the common load used (Kong, Rock Exotica).

Static System Safety Factor - The force of the load at rest divided into piece of equipment with the lowest MBS in the system.

Unplanned Dynamic Event - Any event that causes a shock load or jolt force to the system.

Working Load Limit - Provided by some manufacturers and acceptable for use up to that load. Used in lieu of the Static and Dynamic safety formulas.

It is the responsibility of every Rope Rescue Operator and Technician to determine if the system they are utilizing is “safe”. There has long been the misnomer that our “Safety Factors” for rope rescue in the fire service were required to be 15:1. This is only anecdotally substantiated in the original version of NFPA 1983-1985 and should not be considered valid for our approach to

rigging. A Safety Factor of 15:1 and even 10:1 is not possible to achieve, nor do we want to carry the equipment that would be built for such a purpose. What is achievable is a Dynamic System Safety Factor of between 2:1 and 4:1. This is in line with all our other disciplines and more in line with industrial standards for fall protection.

Organized rescue teams should be diligent in the equipment they acquire ensuring that it serves their mission needs. All equipment, hardware and software, should be tracked and inspected regularly and after each use. Follow guidance from both the manufacturer and NFPA 1858-2018 for the selection, care and maintenance of this equipment. The manufacturer Kong states in their literature that a connector should be retired if it saw a load greater than one-quarter of its MBS or the load it received when Proof Loaded.

The practice of tying prusiks should be eliminated completely. Sewn bound loop prusiks offer a level of safety that far exceeds the cost savings of making your own. Rated sewn terminations can be used as anchor straps with a degree of certainty that un-accounted for tied prusiks cannot. Sewn anchor slings should be used wherever possible for the same reasons. Understanding that rigging can vary from response to response, having some bulk webbing for this purpose is warranted as a backup. The availability and low cost of various length sewn webbing loops should be considered as well.

We are going to assume that the Maximum Anticipated Load will be 6kN, which should be thought of as an injury-producing amount of force. Our training will hopefully keep the actual forces to considerably less than 6kN, but we will use this number to keep our figures conservative and safe by estimating a high worst-case scenario.

We will now determine the Dynamic Factor of Safety of rigging systems of commonly used equipment. To determine a Static Factor of Safety will only engender a false sense of security, as an Unplanned Dynamic Event (UDE) will always generate more force than a static load. All modern DCDs are designed to slip when put under load to absorb some of the energy from an UDE. Unfortunately, the load at which these devices slip will not be as consistent as we would hope for. The construction and condition of the rope may not match the ropes used in the tests, the wear on the DCD and even atmospheric conditions will affect the friction and the reaction of the device to the event. Installing a Load Limiter is a safe and predictable option for any situation where a UDE is a concern. The PETZL ASAP always requires the use of one and the Yates Rescue Load Limiter can be installed in any system to limit the force from 6kN to 2kN if one is used or 4kN if 2 are ganged together. These load limiters do not rely on friction, which can vary considerably between component interfaces, making them more predictable.

Configuration #1
Used to lower an injured worker from the top of a water tower horizontally in a rated stokes basket.

12.5 mm rope with knots	40kN
SMC steel D x 6	40kN
Petzl I'D L x 2	22kN
anchor plates x 2	36kN
anchor straps x 2	45kN
stokes basket w/ rigging	11kN

In this configuration there is no need to de-rate any equipment other than the rope, as it is all being used properly. I put the stokes basket in there intentionally to point out that personal harnesses and patient packaging devices should not be included in the formula. These devices should only be seeing the weight of a single person and are not part of the system, they are hanging on the system. That leaves the rope as the component with the lowest MBS at 20kN after de-rating.

20kN / 6kN = 3.3:1 DSSF.

That's a considerably safe Dynamic System Factor of Safety. By purchasing ropes with sewn terminations, we can increase the strength of the rope from 50% to 85% but the DCD will keep our DSSF still under 4:1.

22kN / 6kN = 3.6:1 DSSF

This may not make our system much stronger, but it does remove some of the possibility that a knot was tied improperly and can increase the speed at which a system is installed and deployed at an emergency.

Configuration #2
Used to raise an injured hiker up a muddy hill vertically in a stokes basket.

11mm rope with knots	32kN
Rock Exotica Rock O x 6	24kN
CMC MPD	14kN
Petzl I'D S	14kN
Rock Exotica 1.5" Omni	36kN
Rock Exotica 1.5" Omni double	36kN
Petzl Basic hand ascender	5kN

In this configuration it's obvious that the Petzl Basic has the lowest MBS of any of the other equipment, but how does it fit into the system, and can it be affected by an UDE? No, it can't. Because the hand ascender is only used while hauling it prevents the rope grab from seeing an impact load, which no rope grab should ever do. Even when loaded the Basic will only see 2/3 of the load. Estimating that at 2.6kN (600lbs) for a 2-

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person load keeps the Basic at a 1.9:1 SSSF and at no time is the load solely the responsibility of the Basic. The MPD has the main strand of the system captive the entire operation.

The rope is at 50% making it 16kN but the DCDs still have a lower MBS at 14kN. 14kN / 6kN = 2.3kN DSSF

Many have been saying that the T rated gear isn't safe, the difference in the DSSF from a traditional G Rated system to a T Rated system is minimal and the T Rated system is still at or above all the other disciplines that we train in. The lightweight gear is not for every team and strong consideration must be given to switching or purchasing gear of that type.

Configuration #3
A high school senior while attempting to hang the school flag from a communications tower, becomes spooked as he encounters a hawk protecting its nest and freezes while climbing the tower.

11mm rope with sewn eyes	32kN
Harken Clutch x 2	22kN
Petzl William x 8	24kN
Anchor plate	36kn
Anchor straps x 4	22kN
Petzl Rescue Pulley x 4	36kN

Rescue team arrives and sets up for a mirrored skate block. Let's de-rate our gear as needed. The rope will keep 85% of its strength because of the sewn termination and no other knots are needed for the operation, 32kN becomes 27kN. All the anchor straps are being used in a basket configuration so 22kN now doubles to 44kN leaving the DCD with the lowest MBS at 22kN.

22kN / 6kN = 3.6:1 DSSF

There are a couple of G Rated 11mm ropes currently on the market, but it won't drastically change your DSSF with either sewn terminations or knots. (3.6:1 sewn as the DCD will have the lowest MBS or 3.3:1 using knots). 11mm rope with knots will produce the lowest DSSF with 32kN de-rated to 16kN for the knots, 16kN / 6kN = 2.6:1 DSSF.

With all the examples provided you can see that even when anticipating a rather large impact and worst-case scenario our gear, when used properly, is incredibly strong. This statement is supported by the reality that we don't read about equipment failures in our industry. We read of

mistakes made by people when they don't have the proper training, the needed practice with the skills to do the job, or all too often, fatigue and stress has played a role in the accident.

Appendix B – Reference Materials / Apps

Title: ***Physics for Roping Technicians***
Publisher: RopeLab
Author: Richard Delaney
Notes: Constantly updated by the author, at no cost. In depth look at equipment, systems and the physics and math in rope rescue systems.
Link: https://www.ropelab.com.au/files/physics.pdf

Title: ***Technical Rescue Field Operations Guide***
Publisher: Desert Rescue Research
Author: Tom Pendley
Notes: App or Paper guide. Covers rope rescue, confined space rescue, swiftwater rescue, trench rescue, structural collapse and helicopter operations
Link: https://www.desertrescue.com

Title: ***CMC Field Guide App***
Publisher: CMC
Author: CMC
Notes: App with charts, diagrams, videos but heavily leans towards CMC products.
Link: https://www.cmcpro.com/app/

Title: ***Animated Knots by Grog (Grog Knots)***
Publisher: Animated Knots
Author: Animated Knots
Notes: Easy to follow, no internet required.
Link: https://www.animatedknots.com/shop

Title: ***RigRite***
Publisher: RigRite
Author: RigRite
Notes: App to calculate complex vector forces easily.
Link: http://rigriteapp.com

Title: ***Risk: SPE, ORMA, and GAR Calculator***
Publisher: NCPTT National Park Service
Author: NCPTT National Park Service
Notes: App to calculate risk assessment scores (GAR Model)
Link: https://ncptt.nps.gov/blog/risk-spe-orma-and-gar-calculator/

Title: ***TerrAdaptor Portable Anchor System Manual***
SMC Gear
Notes: Select which version of the manual you need
Link: https://smcgear.com/terradaptor-portable-anchor-system.html

Title: ***Arizona Vortex User Manual***
CMC Rescue
Notes: Select under the Resources Drop Down for the latest version
Link: https://www.cmcpro.com/equipment/arizona-az-vortex/



Petzl Rope Systems – Second Edition

Appendix C – Mechanical Advantage Practice

RopeRescueTraining.com T-Method Article

CMC T-Method Practice Form

CMC T-Method Practice Answers

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Appendix D – Forms

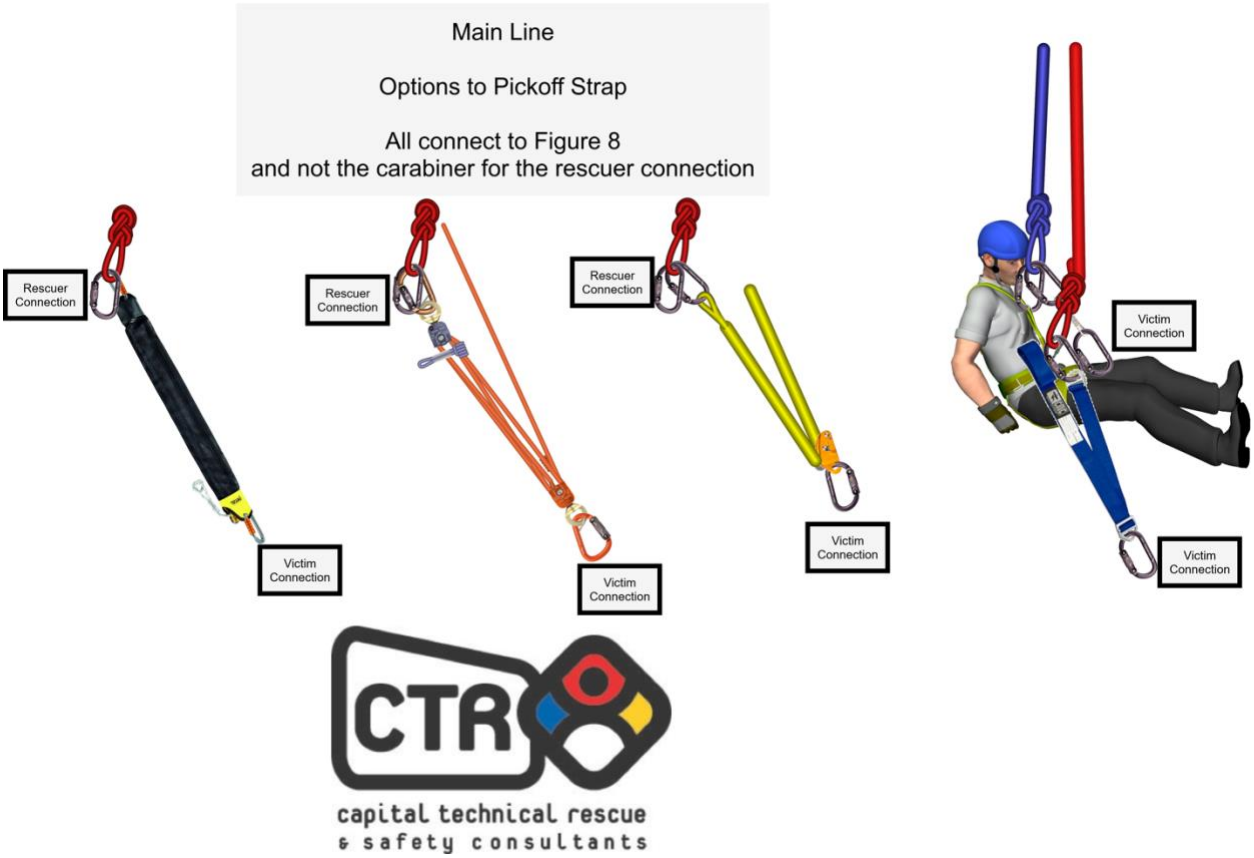
CMC Forms - Rope Log, Hardware Inspection Log etc

Appendix E – Manufacturer Video Links

Petzl Professional Videos

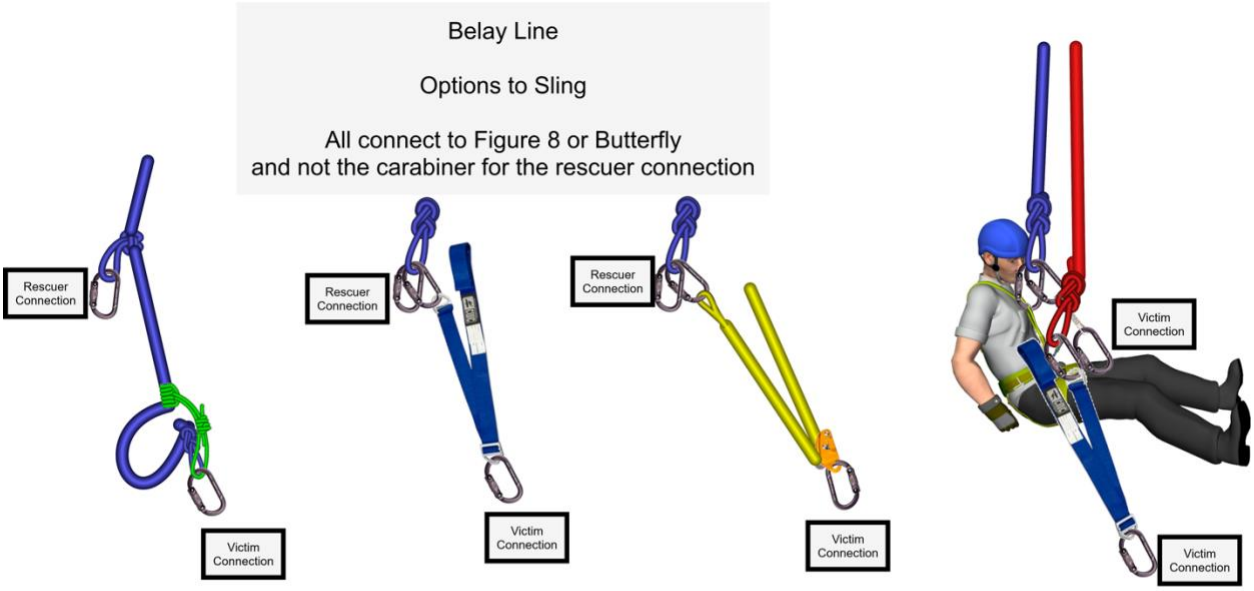
Appendix F – Alternative Rigging Diagrams

Pickoff – System Based Alternatives – Main Line



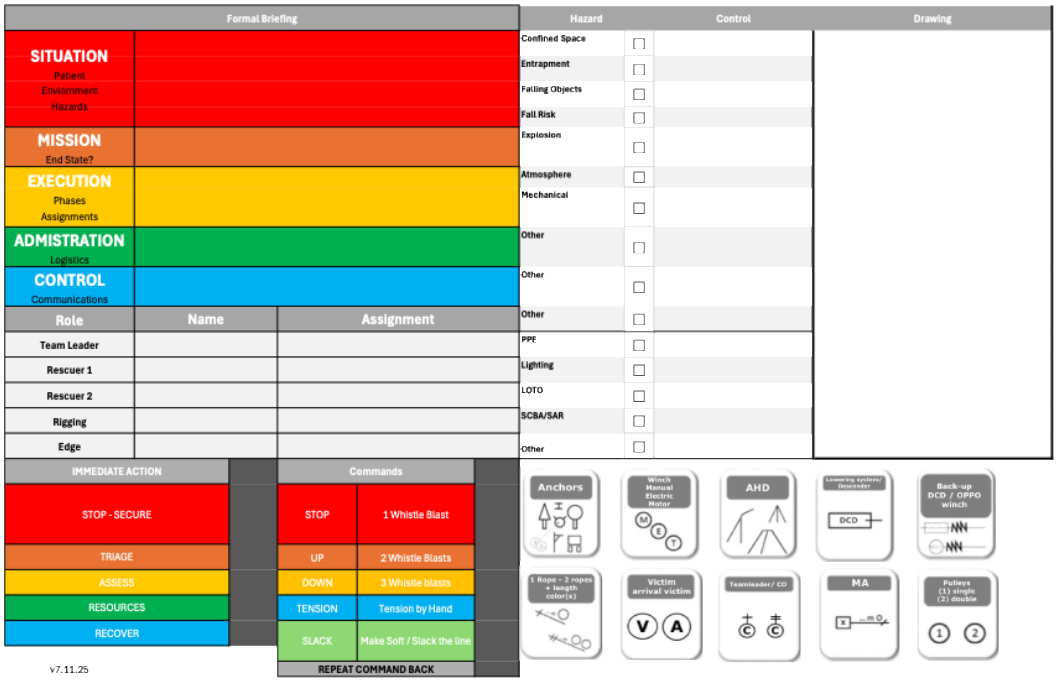
The same devices maybe used for a rappel based pickoff, with the connecting carabiner of the device connecting directly into the DCD carabiner and NOT the rescuers harness.

Pickoff – System Based Alternatives – Belay Line



The same devices and techniques maybe used for a rappel based pickoff, with the connecting carabiner of the device connecting directly into the backup carabiner (ASAP carabiner) or knot and NOT the rescuers harness.

Appendix G – CTR Tactical Worksheet



[Click Here to Download Latest Version](#) (PDF)

Appendix H – The Rescue Playbook Concept

The Rescue Playbook is a framework developed to help rescue teams improve efficiency, consistency, and confidence during high-risk, time-sensitive operations. Rather than relying on improvised rigging decisions made under stress, the Rescue Playbook captures **proven rescue "plays"** — commonly used systems that have been vetted, trained, and repeatedly executed by the team. Much like a playbook in organized sports, these systems provide a shared mental model that allows personnel to rapidly move from assessment to action.

Each diagram in this appendix represents a complete operational solution, not just a rigging configuration. The diagrams are intentionally designed to show **system layout, equipment selection, team positions, and operational intent** in a single visual reference. By standardizing these elements, teams can reduce on-scene decision fatigue, improve communication, and minimize errors related to unfamiliar or ad-hoc systems. This approach reinforces the philosophy that **efficiency is a form of safety**, and that a well-rehearsed system deployed quickly is often more effective than a more complex solution built slowly.

The Rescue Playbook concept was developed in response to a recurring observation in real-world rescues: many teams possess the necessary equipment and individual skills, but struggle to integrate those elements into an efficient, coordinated operation. By identifying common rescue problems and pairing them with pre-planned solutions — such as system-based pickoffs, tripod winch operations, low-angle transitions, or dual-main configurations — teams can focus their attention where it matters most: patient care, hazard management, and maintaining overall situational awareness.

The diagrams included here are not intended to replace sound size-up, problem solving, or adaptability. Instead, they provide a **baseline starting point** that can be adjusted as conditions dictate. Advanced training builds upon this foundation by exploring variations, transitions between systems, and decision-making under changing conditions. Courses and clinics offered beyond the core curriculum expand the Rescue Playbook by introducing additional plays, refining team roles, and developing the leadership and rigging depth required for complex, non-routine incidents.

Ultimately, the goal of the Rescue Playbook is to create teams that are not only technically capable, but **operationally efficient and intentionally prepared**.

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Low Angle Rescue

Low Angle Rescue involves rescuing a casualty on sloped terrain ranging from 15° to 40°. For many low-angle rescues, such as a vehicle down an embankment, a single rope system is often sufficient. However, the system is designed to allow for rapid conversion to a mechanical advantage system (e.g., 3:1 or 5:1) if hauling becomes necessary, and a belay line can easily be added along with secondary connections of litter tenders to the system.

Overview

Main Line Bag

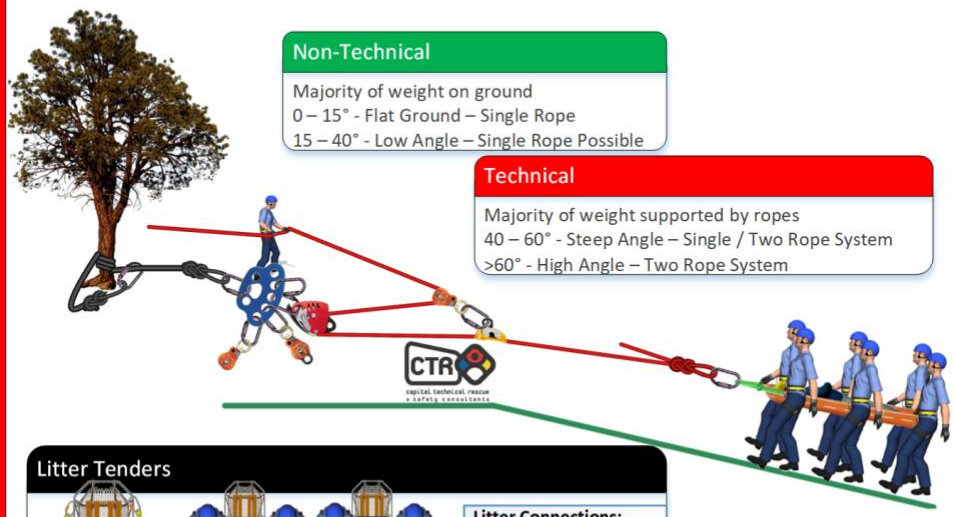
Anchor Plate

- 1 – Anchor Strap w/Carabiner connected to anchor plate
- 1 – 5 hole or larger anchor plate
- 1 – 12.5mm x 200' rope w/figure 8 & carabiner
- 1 – Rescuecender with carabiner and single swivel pulley
- 1 – Double single swivel pulley with carabiner
- 1 – Petzl Maestro L with carabiner
- 1 – Extra Friction Carabiner
- 1 – Single Swivel pulley and carabiner (COD)

Team Positions

Lead
Command

Rescuer 1 – Quick Pt Contact
Rigging – Rig & Operate Systems
Rescuer 2 – Rig Litter, Lead Litter Team
Edge – Assist Rescuer 2



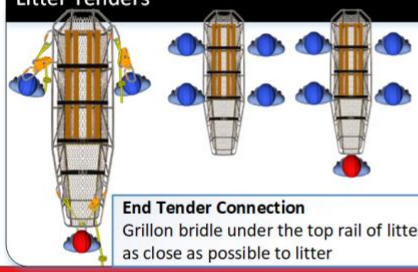
Non-Technical

Majority of weight on ground
0 – 15° - Flat Ground – Single Rope
15 – 40° - Low Angle – Single Rope Possible

Technical

Majority of weight supported by ropes
40 – 60° - Steep Angle – Single / Two Rope System
>60° - High Angle – Two Rope System

Litter Tenders



Litter Connections:
Grillon or Progress Adjust Lanyard

Secondary tie in required when a two rope system is needed

End Tender Connection
Grillon bridle under the top rail of litter, as close as possible to litter

System Benefits

- Provides adaptability to a variety of low-angle scenarios using a single pre-rigged rope system.
- Allows efficient transitions between non-technical and technical operations.
- Maintains simplicity while offering the flexibility to introduce mechanical advantage as needed.
- Simple and efficient setup using a pre-rigged system for rapid deployment.
- Reduces complexity in non-technical scenarios while maintaining readiness for technical needs.
-

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The 1 – 2 (Single Operator Dual Main)

The 1-2 is a dual main system operated by a single rescuer, who manages both descent control devices simultaneously to ensure redundancy and efficiency. A tailer supports the operation by maintaining proper rope flow, ensuring ropes are clear, and assisting with non-fouled rope management as they approach the devices.

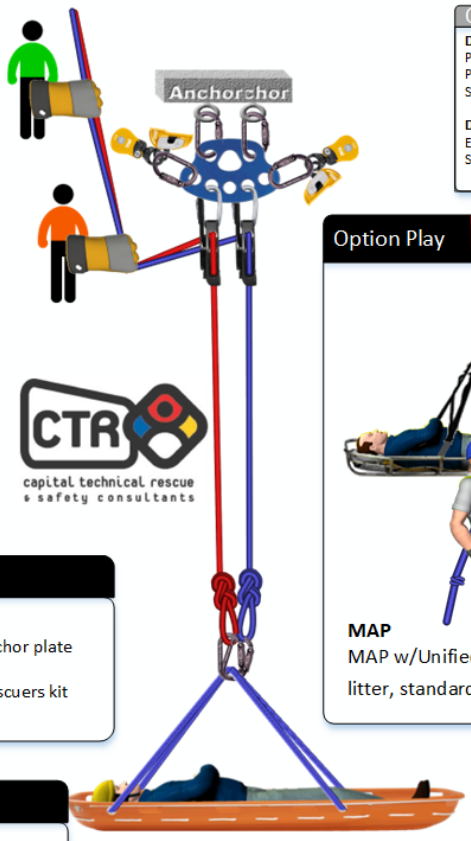
Overview

Connectors
DNA Carabiners (x2)
Oval Carabiners (x4)

Anchor Plate
1 – 3 Hole or Larger Anchor Plate

Descent Control Devices
2 – 11mm Clutches

Rope
2 – 11mm x 300'



Option Gear

DCDs
Petzl Maestro
Petzl ID / RIG
Skylotec Sirius / Spark

DNA Replacement
Extra Carabiners
Sewn Prusik / Sling

Option Play



MAP
MAP w/Unified Butterflies to litter, standard kit for tender.

Rigging for Raise

Build 2 – 3:1 using equipment on anchor plate

OP: Build 2 – 3:1 systems utilizing rescuers kit

Team Positions

Lead
Command

Rescuer 1
Quick Pt Contact

Rescuer 2
Pt Packaging / Litter Tender

Rigging
Rig System / Lead Haul Team

Edge
Assist Rigging

System Benefits

- Ensures full redundancy throughout the load path, from the anchors to the rescue package.
- Allows for efficient operation with a single operator controlling both devices while maintaining safety.
- The tailer provides additional oversight, ensuring smooth rope flow and preventing fouling, which enhances operational reliability.

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System Based Pickoff

Rescuer is lowered on a dual main system with a unified Master Attachment Point (MAP) which ensures true load-sharing between the dual main lines. The rescuer connects to the victim using a combination of a safety/backup device and a positioning device to safely and comfortably transfer the victim to the rescue system.

Overview

System
Dual Main Rope System (11mm x 300')

Rescuer Connection
Figure 8 on bight from each of the Dual Main Lines with Oval Carabiners (x2)

Victim Connection
MAP: Unified Butterfly in arms reach of rescuer

Backup (Safety) Connection
1 – 3m Petzl Grillon

Primary (Positioning) Connection
1 – 2m Petzl JAG

Team Positions

Lead
Command

Rescuer 1
Quick Pt Contact

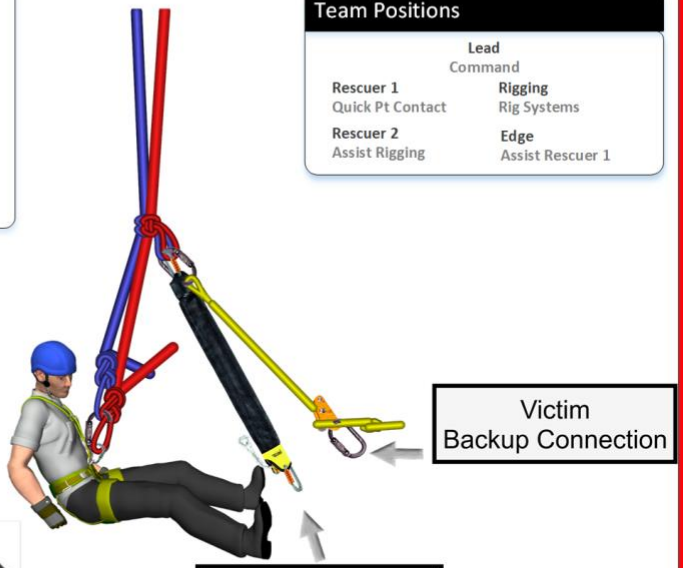
Rigging
Rig Systems

Rescuer 2
Assist Rigging

Edge
Assist Rescuer 1

Optional Connections

Pickoff Strap
Harken Wingman
AZTEKs
Harness Lanyard
Quickdraw



When to Use

Ideal for scenarios requiring precise victim handling and positioning, such as when the victim's condition necessitates additional care.

Suitable for rescues where redundancy and load-sharing are critical, such as high-angle or vertical environments.

System Benefits

- Ensures true load-sharing between the dual main lines for redundancy and balance.
- Provides precise victim positioning for optimal safety and comfort during the pickoff.
- Keeps the rescuer's connections to the system separate from the victim's, ensuring clear and manageable rigging.
- Maintains rescuer proximity to the victim (18"-2') for effective communication and assistance.

Appendix I - Gear Accountability Pool System

Purpose and Importance

Technical rescue training events routinely involve large amounts of equipment from **multiple agencies, instructors, apparatus, and individuals**. At the conclusion of training, gear is often staged together, partially disassembled, or redistributed between teams. Without a deliberate process, this environment creates a high risk for:

- Lost or unaccounted equipment
- Gear being returned with **extra or incorrect items**
- Equipment being placed back in service without the owning agency realizing items are missing
- Inefficient searches through multiple bags, harnesses, and apparatus



To address these issues, Capital Technical Rescue uses the **Gear Accountability Pool System**, a structured, field-expedient process modeled after the **hazmat "pool" concept**.

The system provides a deliberate, visual, and role-based method to ensure that **every piece of equipment—agency-owned or personal—is accounted for and returned to its proper owner**.

This process is not intended to replace agency inspection, cleaning, or documentation procedures. Its sole purpose is **gear accountability and correct ownership return**.

Key Principles of the System

All equipment enters the system before packing or loading
A kit is only considered complete when it:

- Contains all required items, **and**
- Contains **no extra or foreign equipment**
- Personal equipment (especially harnesses) is processed the same way as agency gear
- Loose gear is deliberately consolidated and sorted to reduce search time

There is **no urgency**—the process favors accuracy over speed

Final inspection, cleaning, and disposition decisions remain with the **owning agency**

Roles and Responsibilities

CTR Gear Accountability Officer (GAO)

- Overall control of the system
- Establishes pool layout
- Manages gear flow between pools
- Resolves issues with agency logistics officers

CTR Loose Gear Sorting Oversight Instructor

- Manages the Loose Gear Sorting Pool
- Ensures equipment is correctly categorized
- Confirms appropriate retrieval of loose gear

Agency Logistics Officers

- Account for all gear belonging to their agency
- Conduct kit-level inventory of agency equipment
- Decide whether incomplete kits remain intact or are broken down
- Handle damaged, contaminated, or missing equipment per agency policy

Assigned Inspectors / Sorters

- Assist with kit inventory or loose gear sorting as assigned
- May be from any participating agency

Gear Accountability Pools (Process Overview)

Equipment moves **one direction only** through the following pools unless otherwise directed by an instructor.

Pool 1 – Initial Staging / Triage

All equipment enters the system through Pool 1.
This pool serves as a **triage phase**, allowing for removal of **obvious issues only**, such as:

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- Hardware that clearly does not belong on a harness or kit
- Obvious foreign equipment attached to otherwise intact kits
- Obviously loose items not secured within a kit



Removed items are immediately transferred to **Pool 2 – Loose Gear Sorting**.

No completeness decisions or detailed inspections are made at this stage.

If it is not obvious, it moves forward to Pool 3.

<u>Pool 2 – Loose Gear Sorting</u>
This pool contains all equipment not currently secured within a complete, identifiable kit.

Loose gear is actively sorted by category, and further subdivided as volume dictates. Examples include:

- Carabiners (auto-lock / manual)
- Slings (by length)
- Pulleys (single / double)



This centralized sorting allows missing equipment to be located quickly without searching through multiple bags or harnesses.

Retrieval of loose gear is permitted, but **must be appropriate and confirmed by the overseeing instructor**.

<u>Pool 3 – Kit Inventory (Decision Point)</u>
Pool 3 is where kits and personal equipment are reviewed at the **kit level only**.

The focus is:

- Is the kit **missing any required items**?
- Does the kit contain **any extra or unauthorized items**?

Outcomes from Pool 3:



- Missing items → **Pool 4 – Missing Items**
- Extra items → Extra equipment sent to **Pool 2 – Loose Gear Sorting**
- Complete and correct → **Pool 5 – Completed Gear**

No detailed inspection, cleaning, or serviceability determinations are made unless issues are obvious.

Pool 4 – Missing Items

Incomplete kits are placed in Pool 4 and identified with a **yellow tag**, indicating unresolved accountability.

Kits normally remain intact unless the owning agency logistics officer determines otherwise. Agencies may use loose gear to complete kits when appropriate.

Some kits may remain incomplete due to damage or loss; these outcomes are documented and handled by the owning agency.

Pool 5 – Completed Gear

Pool 5 contains equipment that is:

- Complete
- Correctly configured
- Free of extra or foreign items

Once equipment enters Pool 5, it may be removed and returned to storage or apparatus. Retrieval should be communicated to the owning agency logistics officer.

No formal sign-off is required.

Personal Equipment

Personal equipment—most commonly harnesses—**must pass through the same pool system**. Individuals must demonstrate that:

- Their equipment contains no foreign or unauthorized items
- All personal equipment has been recovered

Once verified, personal equipment enters Pool 5 and may be removed.

Damaged, Contaminated, and Orphaned Gear

- Damaged or contaminated equipment is immediately turned over to the owning agency's logistics officer
- Orphaned or unclaimed equipment is addressed jointly by CTR instructors and affected agency logistics officers
- Equipment discovered after teardown is communicated to instructors and agency logistics officers to determine proper disposition

Completion Criteria

The Gear Accountability Pool System is complete when all equipment is:

- Returned complete
- Tagged as incomplete
- Documented as damaged, missing, or unresolved

Only after this process is complete should final packing and departure occur.

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Appendix J – CTR Rules of Engagement

Starts on next page

2025 Rope R.O.E. (Rules of Engagement)

Live: *With pulse*	***Unquestionable/Certified*** *Will not fail / Tested, Rated*
Redundant: *Will be uneventful if a single failure occurs*	***Non-Certified:*** *No known actual strength rating*
Exposure/Consequence: *Potential for (harm injury to humans) or (damage or failure of gear)*	***Competent:*** *Educated, Experienced Rescuer*
PC: *Progress capture (mechanical or soft)*	***Force Multiplier:*** *Increased force, applies more than the actual load*
Temporary PC: *Two or more rescuers controlling the load*	***Protection:*** *Durable secured material*
Load Path: *All components from anchor to load, including the anchor and load (rescuer/victim).*	***Qualified Anchor:*** *Non-Certified Anchor deemed useable by two or more competent rescuers*

Personal Rules

1. Personal loads ≤ 140 kg. (308lb) shall not be exposed to greater than 12" of system slack or fall potential.

2. Rescuers shall be secured with 2 points of contact. Points of contact: (A&Ox4 rescuer with 3 human points, DCDs, knots, tensioned hitches, **Zero slack** ascenders or hard cams, soft goods, Carabiners, ASAPs, dynamic lead climb concepts). Rescuer SRT may be allowed if deemed to reduce risk to rescuer and/or patient and at the discretion and agreement of 2 competent rescuers.

3. When within 1.5x body lengths of a fall potential greater than 6' rescuers shall take a knee. Any closer shall be on the belly unless secured with work restraint, rope systems or fall protection "100% tie off". (Fall protection may be required by local industry, rules, and/or distances may be greater for sloping, slippery or loose edge areas).

4. Rescuer climbs made in vertical or sloped environments >40°, cages, or confined shafts shall follow the rules of competent climbing, unless deemed to do greater harm.

5. Low angle environments may dictate redundant systems if the consequence/exposure is significant.

6. Rescuers **shall not** rappel without ascent/self-rescue gear appropriate for the task/environment.

Anchors & Rigging

1. Anchors will be Unquestionable**/Certified** or **Non-Certified.** Non-certified anchors will be deemed capable of withstanding the anticipated forces by two or more competent rescuers.

2. Redundant load paths shall be identified for live loads with greater than 6' of fall exposure, **unless deemed to do greater harm** *(Rigging plates, solid or screwed shut rings, Kootenays, and approved anchor points require no redundancy) (Inspect the Rock Exotica Bolt plate).*

3. Reduction of consequence deemed by two competent rescuers may replace redundancy. **(CTR Oversite required)**

4. Live loads ≥ 204 kg. (450lb) shall not be exposed to greater than 12" of fall potential.

5. Single point failure shall not result in load shift or extension beyond 12" vertical, or lateral movement that has potential for harm or damage to the load path.

6. Internal rigging angles ≥ 120° and COD angles ≤ 90° will be considered force multiplying and **shall be** recognized by the rigging group leader (rope angles < 60° will be considered deviations).

7. All live loads shall maintain tool or hitch based PC during suspension, lowering, or hauling operations. (Two rescuers' hands on software may be considered **temporary PC**)

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8. All potentially harmful surfaces to rope or rigging shall require protection and or be evaluated by two competent rescuers.

9. All system force resultants shall be identified prior to loading.

10. Dual Main / TTRS systems will attach to the same physical location of all loads, unless deemed to do greater harm.

Patient Packaging & Rescue

1. Patients with a pulse will have a manufactured harness (victim or Class 3) to a redundant rope system when packaged. Patients packaged in litters (baskets) **shall be** secured with a commercial harness to the litter, with an outer lash for securement, and all extremities secured. Any suspected airway concern will mandate lateral packaging for the pt. Litter patient packaging and litter bridles with a master attachment point deemed acceptable by two competent rescuers **will not** require a direct patient attachment to the rope system.

2. Pulse-less patients may be moved by any method that allows for rapid, life-saving treatment.

Original Concept Arnold Peña – AERT - 2024

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