REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING

R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Curriculum Manual

Revised – March 2009

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This edition of the General Rescue Course was prepared by the RESET General Rescuer Workgroup. The Workgroup reviewed the curriculum January –March 2009.

The original document was produced by the Austin Fire Department Technical Rescue Curriculum Committee. This committee compiled this curriculum April - May 2007. Portions of this material are the product of previous work done by technical rescue specialists in the years leading up to the organization of this document. The remainder of the material was the work of the committee members with input from various sources including members of the technical rescue team and outside technical specialists.

Purpose

This curriculum is not meant to cover all methods acceptable for technical rescue operations. The purpose is to standardize those methods taught during this technical rescue course. All the learning material in this document is intended to cover the Knowledge, Skills, and Abilities (KSA) needed by rescuers at the General Rescuer level.

Scope

The organization of the knowledge, skills and abilities (KSA's) within this curriculum is designed to follow the Job Performance Requirements (JPR) outlined by the National Fire Protection Association (NFPA) 1006 – Standard for Technical Rescuer Professional Qualifications 2008 edition. Standardized organization following NFPA 1006 is intended to allow the rescuers training to be consistent with other emergency response organizations. Each JPR will be accomplished by using techniques specified in this curriculum, and adopted by RESET as the authority having jurisdiction. RESET participating agencies include:

Austin Fire Department
Lake Travis Fire Rescue
San Marcos Fire Department
Pflugerville Fire Department
Austin/Travis County EMS
Cedar Park Fire Department
Westlake Fire Department
Oak Hill Fire Department
Pedernales Fire Department
Round Rock Fire Department
Willamson County EMS
George Town Fire Department
Leander Fire Department

Instructor Obligation

It is the responsibility of all instructors delivering any part of this curriculum to cover all of the learning material covered in the lesson plans. No instructor has the authority to delete, omit, or otherwise leave out any content within the curriculum. Anyone assigned the task of covering any part of this curriculum should build his/her class in such a manner that optimizes instructor style while at the same time maximizing the learning for the students.

The Austin Fire Department
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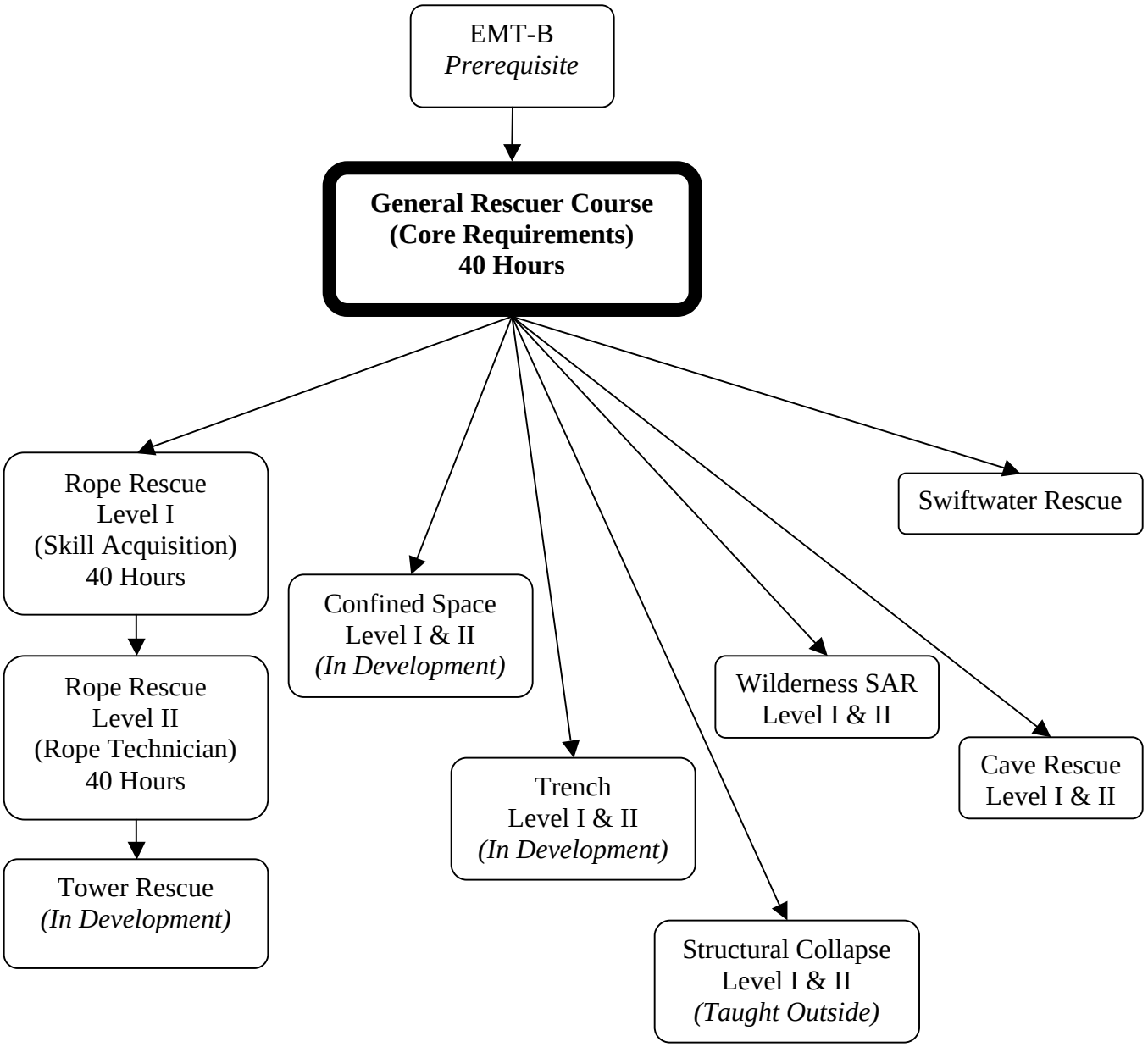
Technical Rescuer Programs



Suggested Schedule

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
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	Day 1		Day 2		Day 3		Day 4		Day 5	
Time	**Lessons**	**Inst. Ratio**	**Lessons**	**Inst. Ratio**	**Lessons**	**Inst. Ratio**	**Lessons**	**Inst. Ratio**	**Lessons**	**Inst. Ratio**
0800-0900	Introduction, NFPA Standards and Course Objectives	1:30	Morning Review	1:30	Morning Review	1:30	Morning Review	1:30	Written Exam	2 Min.
0900-1000	Site Operations	1:30	Anchors	1:10	Belay a Falling Load	1:10	High-Angle Field Work	1:5		
			Belay Systems							
1000-1100	Ropes and Devices	1:30	Raising and Lowering Systems	1:10						
1100-1200	Knots Hitches and Harnesses	1:10			Low- Angle Field Work	1:5			Skills Exam	1:5
1200-1300	Lunch									
1300-1400	Knots Hitches and Harnesses	1:10	Lunch		Lunch		Lunch		Lunch	
			Alternative Comunication (15 min.)	1:5	Low- Angle Field Work	1:5	High-Angle Field Work	1:5	Skills Exam/ Scenarios	1:5
1400-1500	Patient Packaging Litter Movement	1:10	Intro to Hauls and Lowers field Work							
1500-1600										
1600-1700										
1700-1730										

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING

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Rules of Engagement

1. Horseplay is **STRICTLY FORBIDDEN**, especially during any evolution.
2. The use of tobacco products around any rope equipment is not permitted.
3. Helmets will be worn during all evolutions.
4. Gloves are to be worn when handling any rope that has the potential of becoming loaded.
5. Report all equipment that is damaged or dropped from a height of more than Six (6) feet.
6. Instructors and students will be responsible for checking rigging by sight and feel at all times.
7. All rescue evolutions require a separate safety line.
8. No equipment is to be used in an evolution unless an Instructor is present.
9. The word **"STOP"** will be used to stop all activity during an evolution. Any student or instructor may use this word. It is to be used when any unsafe action, potential problem, or an unsafe condition is observed.
10. The words **"FOR REAL"** will be used to designate any problem, which is not part of an evolution.
11. When a **"FOR REAL"** situation occurs, the Instructors will take charge and are in command.
12. The word **"ROCK"** is used to alert everyone of a falling object.

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
NFPA Standards and Course Objectives

NFPA 1006 JPR's:
Not Applicable

Time:
30 Minutes

Scheduling Suggestions:
First Class

Materials/Equipment needed:
Lesson Plan

Instructor requirements:
1:30 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Identify the three NFPA standards that pertain to technical rescues
- Describe the purpose of the three NFPA standards
- Identify the nine course objectives for the General Rescuer Course

NFPA Standards and the Rescue Technician

It is important for search and rescue professionals to understand standards and how they apply to their work. There are three National Fire Protection Association (NFPA) standards that pertain to technical rescue:

- **NFPA 1006**- Technical Rescuer Professional Qualifications 2008 edition (Standard for Rescue Technician Professional Qualifications 2003 edition)

- **NFPA 1670**- Standard on Operations and Training for Technical Search and Rescue Incidents 2004 edition

- **NFPA 1983**- Standard for Life Safety Rope and System Components 2006 Edition

NFPA 1006 is the professional qualification document that details what Knowledge, Skills, and Abilities (KSA's) individual rescuers need to know. 1006 identifies Job Performance Requirements (JPR's) for a variety of technical rescue environments including: rope rescue, confined space, water rescue, etc. The Standard uses a training model called "Core + 1". What that means is that there are "Core" JPR's that all technical rescue personnel should be able to accomplish. These requirements are essential to *all* of the specialty areas of the technical rescue field. Once the core skill set is mastered; the trainee will be qualified for advanced instruction in any of the specialty areas (ex. rope rescue, structural collapse, confined space, etc.) to Level I or II.

NFPA 1670 is a standard set up to identify response capabilities of an organization. A person cannot be trained to NFPA 1670. It is an organizational standard not meant to apply to an individual's training. Emergency response organizations should use 1670 to identify what level of capability they will offer with a given type of rescue. This standard identifies three organizational response capabilities:

- Awareness Level is the minimum capabilities of first in units and provides information on how these individuals should react at a technical rescue incident. It must be stressed that this is not an operational function level.

- Operations Level rescuers are trained to identify hazards, use equipment, and apply limited techniques in low angle or high angle rescues.

- Technician Level rescuers meet all of the requirements of the above plus apply more advanced techniques, coordinate, perform, and supervise technical rescues.

1670 also identifies the need for standard operating procedures, preplanning, the need to provide training to rescuers, etc.

NFPA 1983 is a manufacturer's standard specifying design and performance requirements for equipment typically used at technical rescue incident. It is important to understand that this standard specifically states it is not a user's standard dictating use requirements. This standard identifies testing procedures and minimum performance requirements required to be NFPA compliant. This does not mean rescuers are required only to use equipment that is NFPA compliant.

Course Objectives

The intent of the General Rescuer Course is to meet all of the General (or "Core") requirements identified in NFPA 1006. Once the General Rescuer Course is successfully completed then trainees are qualified to be trained in most specialty areas.

At the end of this course the rescuer should be able to:

- Conduct appropriate site operations at a technical rescue incident
- Identify and operate ropes and devices used at technical rescue incidents
- Tie, identify and appropriately use knots, hitches and harnesses
- Appropriately package a patient in a variety of litters and move them over rough terrain
- Employ safe anchoring techniques for rope rescue operations
- Setup and utilize belay systems for a variety of situations
- Successfully catch a falling load with a belay system
- Build and operate raising and lowering systems in both a high- and a low-angle environment
- Successfully pass the end of course written exam
- Successfully complete a General Rescuer Task Book

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Class Title:
Site Operations

NFPA 1006 JPR's:
5.2

Time:
One hour

Scheduling Suggestions:
This class should follow immediately after class orientation

Materials/Equipment needed:
Class room large enough to accommodate number of students
Computer, projector and screen

Instructor requirements:
1:30 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Identify needed resources for rescue operations
- Size-up a given incident
- Manage incident hazards
- Manage incident resources
- Conduct a search
- Perform ground support for helicopter operations
- Terminate the incident

5.2.1- Identifying Resources

- Equipment Cache
  - At the General Rescuer level of practice an example of the equipment needed might be:

Hardware:

2 - Double Pulley
2 – Single Pulley
1 – Tri-Link
10- Large Carabiner
2 – XL Carabiner
2 – Mechanical Rope Grabs
1 – Rigging Plate

Rope/Webbing:

4 – ½" Kern Mantle Rescue Ropes
2 – 15' x 1" webbing
2 – 20' x 1" webbing
2 – 30' x 1" webbing
2 – Tandem Prusik Pair

Litters/Patient Packaging:

1 – Steel rescue basket
1 – Ferno style solid bottom basket
1 – Short spine splint (OSS, KED, etc.)
1 – Sked type packaging device
1 – Full length back board

Auxiliary equipment:

4 – Rope / edge protection
2 – Adjustable anchor straps
2 – Basket bridal
1 – 10'x10' tarp for equipment staging

  - Personal protective equipment such as helmets, gloves, eye protection, and hearing protection are generally not considered as part of an emergency response equipment cache. Ideally these items should be issued to the individual rescuer along with a means of storage or transport.
  - This equipment inventory should allow the educated rescuer to accomplish the majority of the rescue situations in which you could be expected to encounter.
  - A means of tracking, storing and inventorying the equipment after each use should be establish by the AHJ.

- Personnel Staging
  - Personnel and apparatus staging should take place at a location remote from the command post so as not to interfere with command and control operations. The staging site should not be so remote as to hinder the deployment of resources. Staging site considerations should also include protection from the elements and a guarded view from the general public and media when possible.

- Scene Lighting
  - Scene lighting is directly related to safety and to timely navigation through the scene. Adequate scene lighting can help reduce trips and falls by facilitating the policing of unused equipment on scene and illuminating identified hazards along travel paths. Cyalume sticks and box lights can be used to identify trail heads and turns so that search and rescue personnel do not become misdirected in their efforts to extricate a patient. Good resources for scene lighting may include:
    - Rescue units
    - Ladder company
    - Box lights/flash lights
    - Helmet lights
    - Cyalume sticks marking trail heads and turns

- Environmental Concerns
  - Protection from the environment is an important concern for both the patient and the rescuers. Rain, ice, snow, and temperature extremes can dramatically affect the patient status. The same environmental concerns can also affect the performance of rescuers on scene. In extreme conditions rescuers may need to be rotated more frequently as a safety precaution. Mental lapses and slowed reflexes can become more frequent when rescuers are subjected to extreme weather conditions and could endanger both rescuer and patient. The time of day and the amount of available daylight is an issue of environmental concern that is commonly overlooked. Changing weather conditions is another aspect of the environment that all rescuers should remain alert to. Early identification of all environmental concerns is paramount in safely mitigating these hazards.

- Personnel Rehab
  - Much like personnel and apparatus staging, personnel rehab should be established in a remote location from the command post. This site should also be guarded from the view of the general public and the media when possible. In cases of environmental extremes; busses, nearby structures, or portable shelters may be utilized to cool, heat or shelter rescue personnel. The site should also be kept remote from areas of activity that directly affect the rescue scene so that personnel are not tempted to self-deploy from rehab back into the scene.

- Command will normally appoint a rehab manager at incidents where personnel are expected to be rotated through multiple work cycles or in cases of extreme weather conditions. The Rehab Manager will normally track a member's time during rehab as well as his status to return to operations.
- Medical monitoring for rescuers is commonly established near the rehab site.

- Support Operations
  - Support operations are those activities that are not directly related to the rescue but facilitate the rescue operational objectives. These activities can be anything that does not directly coincide with locating, caring for, or extricating the patient and may include:
    - Equipment staging
    - Traffic control
    - Lighting and marking trails
    - Haul team members
    - Rehab
    - Scene safety

5.2.2- Size-Up

- Dispatch Information
  - Dispatch information will always be limited. We are at the mercy of the caller and what they are able to articulate to the dispatch call center. Information filtering will always occur and by the time the rescuer gets the information it will probably have traveled through at least three sources. Information that we are likely to get may include:
    - Closest known location of the injured person or the caller's location
    - Time of day the call for help was initiated
    - Mechanism of injury if known

- Reference Materials
  - Reference materials are important resources used by both command and field personnel. Command personnel often use maps, incident pre-plans, and other associated reference material to develop and implement an Incident Action Plan for all types of incidents.
  - Maps
    - Used for site reconnaissance and navigation

- Incident pre-plans
  - Incident pre-plans may include such information as:
    a) Rescue team notification procedures
    b) Acceptable entry conditions for rescue
    c) Risk analysis of hazards
    d) Site map
    e) Hazard abatement procedures
      - Control zones
      - Ventilation
      - Lock out /tag out
    f) Command post location
    g) IMS org chart
    h) Safe work practices
    i) Medical assistance
    j) Communication issues
    k) Probable rigging locations
- Initial response planning worksheet
  - Response objectives
  - Non-entry rescue options
  - Entry type rescue options
  - Are your capabilities and equipment appropriate for the available rescue options?
  - Needs analysis and procedure for emergency decon.
  - Scene control
  - IMS
  - Non-entry retrieval
  - Qualifying entry type rescue
  - Emergency decon
  - Technical level rescue assistance

- Rescue Type
  - Land
    - Flat w/ difficult access
    - Slope
    - High angle
    - Lost person(s)
  - Water
    - Flat water
    - Moving water
    - Flood water
    - Surface/ Sub-Surface
    - Open water
  - Confined Space
  - Trench
  - Structural Collapse
  - Cave

- Vehicle/ machinery
- Ice
- In addition to determining the specific type of environment in which the rescue will take place, the rescuer must also consider if the operation will be in the **rescue mode** (a viable patient) or the **recovery mode**. This assessment will help determine the acceptable level of risk for the rescuers. The type of rescue incident and the mode of operations may need to be modified due to changing scene conditions and/or protracted time lines. Rescue type and mode will need to be periodically re-evaluated to insure rescuer safety.

- Identifying number of Victims
  - Identifying the number of victims will help in determining if you have the needed resources to affect a safe and timely rescue.

- Point Last Seen for each Victim
  - The point last seen is the last known or witnessed location of the patient or lost person if the subject's exact location is not known.

- Identify and interview witnesses
  - Identifying and interviewing witnesses will be a primary source of information for the rescuer at an incident scene. It will also be advisable to retain witnesses in the event that the rescuers need additional information. In the case of multiple witnesses it is often advisable to separate the witnesses from one another so that the witnesses do not become confused about what they actually remember versus what the person next to them remembers about the incident. Some tools that may be of use in identifying and interviewing a witness are:
    - Missing person questionnaire
    - Con-Space entry permits
    - Cut Sheets

- Identify search parameters
  - Define the search area
    - The search area will be defined by information gathered on scene from witnesses and other sources about the missing person.
  - Containment
    - Once the borders of the search area are defined, the subject of the search must be contained within the established search area. This is to insure that the subject of the search does not escape the search area while efforts are being made to locate them. This will normally be accomplished by placing personnel at areas of egress and also by using impassible manmade and natural barriers to define the search area when possible.

- Control access and exit points
    - It is just as important to control access into the search area as it is to control the exit points. This is true for both rescuers and civilians. If access to the search area is not controlled then the scene may become "contaminated" with outside signs and clues. These extra "clues" may lead rescuers on the wrong path and hinder or slow search efforts.

- Assess needed resources
    - Assessing the amount of resources that you will need to complete a rescue operation go hand in hand with developing and implementing an effective Incident Action Plan. A list of resources to consider should include:
        - Personnel needs
        - Special equipment needs
        - Traffic/Crowd control
        - Rehab for rescuers
        - Decon for rescuers and patients
        - Medical transport options
        - Time constraints of the incident

- Develop an Incident Action Plan
    - A well developed Incident Action Plan will aid rescuers in identifying and anticipating scene hazards and concerns for patient care and transport. Information that you might see on a typical Incident Action Plan should include:
        - Incident #
        - Date
        - Time of day
        - Location
        - Situation and conditions on arrival
        - Estimation of hazards
        - Safety considerations
        - Strategic goals
        - Tactics to be employed
        - Team assignments

- As apart of the Incident Action Plan the incident command structure should be identified:

Incident Command
(Command Staff Positions)
Incident Safety
Public Information Officer
Liaison Officer
(General Staff Positions)
Operations
Rescue Group
Medical Group
Plans
Situation Status
Resource Status
Demobilization
Logistics
Rehab
Equipment acquisitions
Finance

5.2.3- Managing Incident Hazards

- Scene Control
  - Control of the incident scene will not only help to insure rescuer safety through the identification and removal of scene hazards but also assist with access, care and extrication of the patient. Some methods that may assist you with controlling an incident scene would be:
    - Establishing control zones (Hot, Warm, Cold)
    - ICS system
    - Limit entry and exit of the area
    - Isolate public from the hazards
    - Park apparatus to block traffic when necessary

- Determine PPE
  - The correct selection and application of personal protective equipment is paramount to insuring rescuers safety and the selection of the appropriate equipment should be based on the suspected and identified hazards present at the scene.
    - Steep/Rough terrain
    - Still/Moving water
    - Haz-Mat
    - Con-Space
    - Trench edges
    - Bodily fluids
    - Potential for falls
    - Changing /inclement weather conditions

- Hazard Identification
  - Before you can mitigate any hazard you must be able to identify it. Examples of Hazards that may be found at various rescue incidents include:
    - Overhead hazards (falling rocks, wires, trees)
    - Falling off a cliff or building
    - Rough terrain
    - Sill/moving water
    - Trench edges
    - Energized systems
    - Industrial processes
    - Potential chemical exposure- MSDS
    - Diminishing light conditions
    - Inclement Weather
    - Getting lost

- Hazard Isolation and Mitigation
  - Some examples of ways to mitigate various hazards might include:
    - Setting up Hot, Warm, and Cold zones
    - Lock-out/Tag-out
    - Shut down equipment around trench collapses
    - Shoring trenches
    - Lighting the scene where visibility is reduced
    - Providing edge attendant lines in high angle environments.
    - Ventilation of any space that the atmosphere is suspect.
    - Marking trail entry points, turns and "Y's"
    - Securing objects on a slope or near an edge in place
    - Barricades/ barriers around trenches and fall zones
    - Policing up unused equipment

- Identify/Confirm Lock-out/Tag-Out
  - A general definition:
    - A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
    - **Lock-Out device**. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

- **Tag-Out device**. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tag-out device is removed.

- Risk/Benefit analysis
  - All rescue situations require an honest risk-to-benefit analysis before action is taken.
    - Assess Patient Viability
      - How long have they been down
      - What are they exposed to
      - What is the extent of the injury
    - Identify risk to rescuer
      - What will you be exposed to
      - How long will you be exposed
      - How will I minimize the risk
    - Identify risk to Victim
      - Do I have time for proper packaging
      - Is it a grab and go event

5.2.4- Manage Resources

- Establish an Incident Management System

Incident Command
(Command Staff Positions)
Incident Safety
Public Information Officer
Liaison Officer
(General Staff Positions)
Operations
Rescue Group
Medical Group
Plans
Situation Status
Resource Status
Demobilization
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Finance

- Establish Communication
  - Effective communication is vital to a safe and effective rescue operation. Communication equipment choices will largely be dictated by the available equipment, atmospheric and environmental conditions at the scene. Some examples of equipment that may be available are:
    - Fire Department Radios
    - Con-space hard wire system
    - Cave Phones (TA-312 military field phones)
    - Family frequency radios
    - Verbal contact (person to person communication)

- Track on-scene resources
  - Tracking of on scene resources is a function of the Plans section of an Incident Command System. Methods for assuring that resources are properly identified and tracked on scene are:
    - Defining a staging area for equipment
    - Defining a staging area for personnel
    - Controlling access to the work areas
    - Performing periodic Personnel Accountability Reports for deployed rescuers
    - Establishing a defined rehab area and appointing a rehab manager to track personnel in and out of rehab.

- Personnel accountability
  - Personnel accountability may be accomplished through working in teams, maintaining company integrity at incidents, moving to and from rehab in teams or groups, and periodic Personnel Accountability Report (P.A.R.) requests from the command post.

- Documentation
  - The documentation of an incident is important not only in managing an incident's resources and personnel but also as a tool for after action reviews and continuing education of rescuers. Methods of documenting an incident could include:
    - Incident Action Plan
    - Tactical Worksheets
    - Incident Logs
    - Task Assignments Worksheets
    - Exposure reports
    - Electronic NFIRS reports

- Applicable Reference Material for Managing Resources

- Maintaining a current list of resources can aid in rescue activities where special circumstances arise. Reviewing a list of the specialized equipment available within your department or through mutual aid resources can aid in the decision making process for rescue operations. It may bring to light options that were not considered during the initial size up.

- Standard Operation Guidelines
  - It is important to be familiar with all departmental policy regarding rescue situations and it is also advisable to be aware of the policies of the surrounding agencies in areas were mutual aid response is a possibility.

5.2.5-Conduct a Search

- Establish Containment Area
  - Once the borders of the search area are defined, the subject of the search must be contained within the established search area. This is to insure that the subject of the search does not escape the search area while efforts are being made to locate them. This will normally be accomplished by placing personnel at areas of egress and also by using impassible manmade and natural barriers to define the search area when possible. Examples of good borders for a search area that would serve to contain the subject might include:
    - Roadways
    - Impassable natural barriers such as lakes
    - Wide and or swiftly moving rivers or streams
    - Tall fences with barbed wire
    - Tall bluffs

- Control Entry and Exit in Search Area
  - It is just as important to control access into the search area as it is to control the exit points. This is true for both rescuers and civilians. If access to the search area is not controlled then the scene may become “contaminated” with outside signs and clues. These extra “clues” may lead rescuers on the wrong path and hinder or slow search efforts.

- Identify and Interview Witnesses
  - Identifying and interviewing witnesses will be a primary source of information for the rescuer at an incident scene. It will also be advisable to retain witnesses in the event that the rescuers need additional information. In the case of multiple witnesses it is often advisable to separate the witnesses from one another so that the witnesses do not become confused about what they actually remember versus what the person next to them remembers about the incident. Some tools that may be of use in identifying and interviewing a witness are:
    - Missing person questionnaires

- Con-Space entry permits
- Cut Sheets
- Witness Triangulation-Where were they standing when they saw, heard, or witnessed the incident.

- Establish a Victim Profile
  - The information listed on a missing person questionnaire should help the rescuer develop a clear picture of the subject's habits, age, physical description, medical conditions, and a point last seen. This and any other pertinent information concerning the subject's mental or emotional status can be used to establish a victim profile.

- Identify and call for any special search resources
  - Identifying and calling for specialized search equipment and personnel is directly linked to effective management of resources and should be incorporated into the Incident Action Plan as a part of an ongoing size-up of the incident. It is advisable to maintain a current list of available search resources from within your department and from mutual aid sources. A list of resources might include:
    - Trained search personnel
    - Search dogs
    - Equestrian search teams
    - Handheld GPS units
    - ATVs
    - Search Helicopters
    - Mapping resources
  - Included in this list should be point of contact information for each resource.

- Identify Point Last Seen
  - The point last seen is the last known or witnessed location of the patient or lost person if the subject's exact location is not known. This will be established through witness interviews and/or witness triangulation.

- Match personnel assignments to their expertise
  - Search operations will be most effective when trained personnel are tasked with assignments in the area of their expertise. In other words, don't leave your best tracker at the command post to assist with communications.

- Collecting evidence
  - Evidence should be tagged, marked with a way point when possible, and left undisturbed unless otherwise directed by the command post or law enforcement.

- Self rescue

- All rescuers should be trained and equipped for self rescue in the event that circumstances around a rescue operation deteriorate. A short list of essentials for self rescue in a search environment would include:
  - A light source
  - Water
  - Food
  - Compass
  - Map
  - Wet weather gear
- Search personnel should be properly trained in wilderness survival techniques, navigation and, sheltering in place before being deployed into the field.

5.2.6- Perform ground support operations for helicopter activities

- SOG's for Helo activities:
  - Be familiar with your agencies policy for working around and communicating with helicopters.

- Scene Control:
  - Control of the incident scene will help to insure rescuer safety through the identification and removal of scene hazards. Some methods that may assist you with controlling the helicopter landing zone would be:
    - Establish a control zone
    - ICS system-establish a clear chain of command for helicopter activities.
    - Limit entry and exit of the area-- No one goes to the landing zone without command post approval.
    - Isolate public from the hazards
    - Park apparatus to block traffic when necessary

- Landing zone requirements
  - The criteria for a landing zone should include level terrain when possible and should avoid overhead hazards such as trees and electrical wires. For the safety of rescuers, civilians and the patient; set and maintain barricades from all directions. The site should be a safe distance from the emergency scene and all loose objects that could become projectiles should be secured or removed from the area.
  - Some helicopters in the area only require a 75' x 75' landing zone. Be familiar with the requirements of the aircraft in your area.

- Aircraft Safety systems

- Stay low
- Wear eye/ ear protection
- Maintain visual contact with the pilot and receive pilot approval before approaching the aircraft.
- Avoid shining lights directly at the helicopter

- Communications Protocols
  - Direct radio contact will be the most effective means of communicating with the helicopter pilot.
  - A radio channel for coordination of the landing zone may be assigned by Communications, otherwise the incident channel will be used to coordinate aircraft landing.
  - When speaking to the pilot over the radio, try to give as complete a visual picture as possible.
  - Describe landmarks and general location of the site and then follow that with the specific location of hazards.
  - Speak from the helicopter's directional viewpoint.
  - On approach, when giving the pilot directions such as "left" or "right", be sure to follow with a "stop" command when the nose of the helicopter is facing you.

5.2.7- Terminate Incident

- Personnel Accountability
  - Upon terminating an incident, one of the first details that will need to be addressed is to account for all of the rescue personnel. This is typically accomplished through a personnel accountability report initiated by the plans section of the incident management system at the direction of incident command. Directly related to personnel accountability is decontamination of rescuers and the documentation of any exposures.

- Secure Scene
  - As a rescue agency we have an implied responsibility to remove or neutralize any hazards that may endanger the public once the rescue is complete. At times this may not be possible and the best that we can do is to isolate the public from the hazard. This can be accomplished through restricting access to the affected area, leaving energized sources locked-out so that they cannot be accidentally activated, or even relinquishing control of the scene to local law enforcement. In instances where a crime has been committed or is suspected it will be crucial to document all entry and exit activities.

- Local Medical Transportation

- If rescue personnel have left the scene to assist with medical transport those personnel must be located and retrieved as part of the demobilization process.

- Critical Incident Stress Debriefing
  - Critical Incident Stress Teams may be located within your own department or may assist from sister agencies such as local law enforcement victim services or municipal employee assistance programs.

    - The Critical Incident Stress Team may respond directly to the scene:
      - Mass casualty incidents
      - When requested by IC or Safety Chief
    - The Critical Incident Stress Team will normally be activated for:
      - Line of duty deaths
      - Suicide/ homicide of a peer
      - Disaster/mass casualty
      - Traumatic child related incidents
    - Debriefing are usually recommended for recommended for:
      - Line of duty injury
      - Suicides
      - Violent incidents
      - Where victims are known to rescuer
      - Personal threats are made to rescue team members
      - Incident with high level of immediate or delayed emotional impact
- After action review
  - Should happen after every call where actions were taken to rescue a person.
    - What went right
    - What could have been better
    - Identify areas of deficiency for future training

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Ropes and Devices

NFPA 1006 JPR's:
5.4.1, 5.4.2, 5.5.3

Time:
2 Hours

Scheduling Suggestions:
Should be one of the first few classes

Materials/Equipment needed:
Examples of various equipment, room to give presentation that is conducive to learning, AV/computer if needed

Instructor requirements:
1:30 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Define the terms Component and System
- Define Minimum Breaking Strength
- Describe the scope and purpose of NFPA 1983
- Identify and employ the Selection, Use, Care, and Maintenance of rope and webbing
- Identify the Minimum Breaking Strengths of rope and webbing
- Identify and employ the Selection, Use, Care, and Maintenance of the various Auxiliary Equipment System Components
- Identify the Minimum Breaking Strengths of the various Auxiliary Equipment System Components
- Define Selection, Use, Care, And Maintenance of Harnesses
- Define Selection, Use, Care, And Maintenance of Litters
- Describe the application of Static System Safety Factors (SSSF)

Components vs. Systems

A **System** is the sum of many components put together to serve a task.

- Haul System
- Fixed Single Rope Technique
- Lowering System
- Belay System

Components are the individual pieces of equipment that are utilized in the construction of a system. These are the tools of the trade. It is now your job to commit to memory uses, Minimum Breaking Strengths, limitations, etc. of the various components used for technical rescue.

Minimum Breaking Strength (MBS)

Component Strength – Component Strength is the Minimum Breaking Strength (MBS) of a single piece of gear. That strength is often based on a test method that "test" the strength in a specific laboratory simulation of field use that may or may NOT be similar to your planned use. Many components now have their MBS rating marked on the device. Either in actual MBS and/or with the NFPA E (escape use – designed intent is for personal escape of single person body weight), L (light use – design intent is for one person climbing or rappelling or rescue use) or G (general use – design intent is for two persons suspended on the gear) rating system. Weakness from wear, age, misuse and other factors can lower the original "new" MBS rating. Note: The proper unit for measuring breaking strength is a force unit not a measure of mass or weight. We use pounds force or kilonewtons (k/N) not pounds or kilograms. 1 kN is equal to 224 pounds force. 3 Sigma rating for NFPA gear is the result of subtracting three standard deviations from the mean of a set of breaking strength test results. Make allowances for age or other degradation of gear when considering MBS.

- Known vs. Assumed
- Degradation Factors

Some manufactures do not build and mark gear to a published standard. They may have other definitions of what the breaking strength for their equipment is. Some gear manufacturers do not even tell customers how they arrive at the numbers in their catalogs. The markings and the 3 sigma MBS system used by NFPA, ASTM and others is as follows: 3 Sigma rating for NFPA gear is the result of subtracting three standard deviations from the mean (average) of a set of breaking strength test results. This means 99.97% or so of components made to this exact same design should have a breaking strength above the 3 Sigma rating.

NFPA 1983 (Standard for Life Safety Rope and System Components 2006 Edition)

A brief discussion about NFPA and it application to equipment.

Scope of 1983
This Standard defines design and performance requirements for equipment. It is a manufacturers standard detailing testing procedures indicative of how the fire service uses rescue equipment. This standard does NOT specify use requirements.

Though there is good information in this standard, and others like it (ATSM), they should only be used to guide users in their decisions on what to buy when purchasing equipment.

- **Light Use**- A designation of system components or manufactured systems designed for light-use loads and escape.
- **General Use**- A designation of system components or manufactured systems designed for general-use load, light-use load and escape.
- **MBS for components**- varies with different components. Know your MBS's.

Life Safety Rope and Webbing:

Rope Types by Use
- Life Safety- Ropes used for lifelines and nothing else.
- Utility- Ropes used for anything else. A utility rope should never be used for life safety purposes.

Rope Construction Materials
- Natural fibers- Natural fiber ropes are for utility use only. Some examples of natural fiber rope are manila and cotton.
- Synthetic fibers- Examples of synthetic ropes are nylon, polypropylene, polyester, polyethylene, aramid, and gel spun polyethylene.

NYLON Rope Properties – Whether static, low stretch, or dynamic, nylon ropes share a few basic properties simply by virtue of being made of nylon material. The reason that most life safety ropes are made of nylon is that nylon is quite strong, but still has comparatively high elongation characteristics, which makes it forgiving when we do fall on it, like in Belay system actuations.

- Type 6 and 6,6
- 7.8 to 10.4 grams per denier (g/d) breaking tenacity (strength of individual fibers)
- 1.14 specific gravity (it sinks)
- 15-28 % elongation (stretch) at break
- Excellent shock absorption ability
- 250° F high temperature working limit
- Melts at 420° (6) to 480° F (6,6)
- Very good abrasion resistance
- About 10% stronger than polyester – dry
- Will lose up to 15% of strength when wet
- Good energy absorption even when wet (twice polyester)
- Chemical resistance – mild acids to stronger alkalis (pH 6.5 to 10.5)

POLYESTER Rope Properties – Polyester ropes have recently become more popular among rope users. This may be at least partially due to the low cost of polyester. Note, however, that polyester as a fiber has only about half the inherent elongation that Nylon does. Other characteristics, including strength and heat resistance, are relatively comparable to that of nylon.

- 7 to 10 g/d breaking tenacity
- 1.38 specific gravity (it floats)
- 12-15 % elongation (stretch) at break
- Fair shock absorption ability
- 275° F high temperature working limit
- Melts at about 480° F
- Good resistance to acids and mild alkalis (pH 3.5 to 7.5)
- Good abrasion resistance
- High tensile strength even when wet
- Low elongation
- Dynamic energy absorption lower than nylon

Some rope users select polyester for its chemical resistance. In fact, polyester is more resistant to acids under high intensity exposure, but when it comes to alkalis, nylon is more resistant than polyester. In either case, the rope must be exposed to incredibly high concentrations for long periods of time or, be exposed to intense heat at the same time in order for deterioration of the fiber to be significant. It is also important to note that the exposure limits that would destroy the integrity of a life safety rope are so intense that the user would most likely be destroyed first! That said, *any* rope that is subjected to *any* significant chemical contamination should be retired as soon as possible. Things to be

particularly careful of with polyester rope are its lower dynamic energy absorption, and the fact that it is more 'slippery' to rappel, lower, or belay with than nylon.

Polypropylene/Polyethylene Rope Properties- These ropes are commonly found in water rescue operations because their specific gravity is less than 1 (indicating they will float). These fibers are typically weaker than nylon or polyester, yielding a lower MBS. Another characteristic that would make these ropes less than desirable for regular rescue applications is their low melting temperature. Depending on the material, many of the "floating ropes" will have detrimental effects if exposed to temperatures as low as 150˚ F! Often the friction produced in decent/friction devices is above the 150˚ mark so it is important for us to know our equipment/rope and not use a "floating rope" for other rescue operations.

Rope construction:

- Laid (twisted)
- Braided
- Braid on Braid
- Kernmantle

These are all construction methods common in the manufacturing of rope. The typical life safety rope made and used for rescue is that of kernmantle (German for Core-Sheath) construction. Kernmantle rope is manufactured with the core making up the bulk of the rope thus being its main load bearing component. The sheath is woven around the core and primarily serves as a protective covering for the core. With loads typically seen during rescue operations it is likely that the sheath bears little if any of the force applied to the rope. There are many different sheath types that have different handling and performance characteristics. Know what yours is and how it may differ from others.

Rope Elongation

You should know which type of rope you are using!

Static

- Static is preferred in rescue due to its low elongation (stretch) properties. When building rescue systems low elongation is desired. For example when a rescuer pulls on a haul system there is an immediate reaction or as someone ascends a fixed rope there is minimal bounce.
- *Note: Not all "Static" ropes are the same. Different brands/models have different elongation properties and in turn they have different handling and use characteristics.*

Dynamic

- Dynamic rope has high elongation properties compared to static rope. This is desired when a high impact force is expected. Rock climbers typically use dynamic rope when lead climbing. Dynamic rope can be found in rescue caches for lead climbing, or other operations where high impact forces are possible. This is most typical for Tower Rescue or "bottom up" rescues.

Minimum Breaking Strength
Typical rope used for technical rescue operations range from 9.5mm (3/8") to 16mm (5/8") in diameter. Each diameter has its applications, and no one diameter will work for them all. It is important to note that strength is not the only factor to consider when selecting a rope. Elongation, expected loading, intended use, availability of other ropes, weight, etc. are all factors to consider. One characteristic that may be more critical than most, is its compatibility with the other components. If the rope will not fit in the devices being used it would be a poor choice.

NFPA 1983 MBS Requirements
Light use
- MBS- 20 k/N (4496lbf)
- 9.5mm (3/8") or greater and less than 13mm (1/2")

General use
- MBS- 40kN (8992lbf)
- 11mm (7/16") or greater and not more than 16mm (5/8")

Personal Escape Rope
- MBS- 13.5 k/N (3034lbf.)
- 7.5mm (19/64") or greater and less than 9.5mm (3/8")

Though these numbers are typical of most ropes it is very important to know your equipment and what its MBS is. Some factors that affect the ropes MBS are:
- Knots- depending on the knot it may reduce the strength around 30%
- Bends- anytime the rope is bent over any edge or in a knot the strength is reduced.
- Other factors- such as those above (wet rope, equipment interface, etc.)

Webbing

Construction
Webbing is a common staple in rescue work of any kind. Most often it is made from nylon. There are two major types of webbing construction: tubular and flat. Both have found their place in rescue work. Tubular webbing is typically lighter and holds knots better than flat webbing. Flat webbing is inherently stronger and more abrasion resistant though it is marginally heavier. Whichever type of webbing is used, ensure it was manufactured by a reputable manufacturer and was made for life safety applications.

Strength
One inch tubular webbing usually has an MBS of 18 k/N (4000 lbf) and when doubled its strength is doubled. When a water knot is tied in tubular webbing it reduces its breaking strength by about 25%. There are two types of tubular webbing construction: Needle Loom and Shuttle Loom. Both are acceptable for our applications.

One inch flat webbing usually has an MBS of 27 k/N (6000 lbf) and when doubled its strength is doubled. When a water knot is tied in flat webbing it reduces its breaking strength by about 25%.

Uses

- Anchors
- Swiss seats
- Patient packaging
- Basket rigging
- Hasty harnesses
- Load-releasing hitches

NFPA 1983 MBS Requirements
NONE

Rope and Webbing care:

Inspection
Inspections should occur before and after every use. It may not be prudent to take the time during a rescue to inspect every inch of the rope/webbing. When deploying rope/webbing during an operation, a pre-use inspection can be done. After any operation the rope/webbing should be inspected to ensure it is still useable. Anytime there is a question regarding its condition, the rope/webbing should be removed from service.

- **Tactile Inspection**- This is actually feeling the rope, running it through your hand and feeling for lumps, soft spots, hard spots, or any deformity in the rope.
- **Visual inspection**- Look for discoloration, abrasion or any abnormality in the rope.

Cleaning

- Front load washing machine
- By hand in a tub
- Rope washer
- Mild soap and water (NO detergent)
- Fabric softener will aid in keeping the rope supple

Drying

- Out of the sun
- Hanging
- Loosely coiled

Storage

- Rope bag
- Cavers coil
- Daisy chain
- Away from chemicals

Rope Log
A Rope log should be kept with the following information

- Manufacturer
- Date of Manufacture
- Lot number from the manufacturer
- Material
- Diameter
- Date put in service
- Length
- Color
- A place to log uses and inspections

Taking rope/webbing out of service

- When it fails inspection
- Exposed to chemicals or heat
- Shock loaded
- Age of the rope
- Overloaded

Auxiliary Equipment System Components

Auxiliary Equipment: System components that are load-bearing accessories designed to be utilized with life safety rope and harnesses including, but not limited to: ascending devices, carabiners, descent control devices, rope grab devices, and snap-links.

Carabiners and Snap-link System Components

Carabiner Materials
Steel vs. Aluminum

- Steel is stronger than aluminum but not all steel carabiners are stronger than aluminum carabiners. Know your equipment.
- Steel is heavier
- Steel tends to be more resistant to wear and abuse
- Aluminum will not rust

Plated or Galvanized steel vs. Stainless Steel

- SS is weaker and more expensive
- SS doesn't easily rust

Carabiner Shapes
Ovals — Inherently weaker due to position of load. Equal load to spine and gate sides put same force on both sides. This produces a weaker overall strength.

D or Offset D – load against the spine = greater overall strength
Typical strengths vary by manufacturer and material. Check actual marked strength of the carabiners you are using.

Pear Shape—Best for Munter Hitches (weaker overall)
The rounded frame end at the large end makes it easier for a Munter hitch to flip when reversing direction of travel of the rope. When tested in standard test method it often has the same strength as D's but the wider end makes it easy to load away from spine. Should be used with care in rigging of rescue loads. When using with Munter hitches, tie so that the rope going to the load is nearest the spine of the carabiner and the end in the belayer's hand comes off the gate side of the hitch.

Locking vs. Non-Locking vs. Auto-lock Carabiners –
It is often best to use locking carabiners for rescue applications. There are two major types of locking mechanisms: screw gate and auto-locking.

Note: some auto-locking carabiners are a 2 step process (twist and then push or pull open) and some are a 3 step process (lift up or push down, twist and swing open.) to open. Auto-locking carabiners are more sensitive to dirt or muck clogging them up. This may prevent them from swinging closed and/or fully locking.

There are times, non-locking carabiners will be acceptable (lead climbing, cows-tails, etc…).

Carabiner Parts

- Spine
- Gate
- Hinge
- Collar (if locking)
- Nose
  - Latch
  - Hook
  - Pin
  - Key

Minimum Breaking Strength
The strength of carabiners varies from make, model, type, material, etc. Be aware of what variation you have in use and use it correctly. Some typical "rules" that are common to most carabiners are:

- Load along its long axis(along the spine) (the further toward the nose the load is the weaker the carabiner becomes)
- Loading along its minor axis (side loading) will typically reduce the strength by 70%
- Avoid 3-way loading- typically reduces strength by 30%

NFPA 1983 MBS Requirements

- Light use carabiners and snap-links with the gate closed, shall have a major axis MBS of at least 27 k/N (6069 lbf.)
- General use carabiners and snap-links with the gate closed, shall have a MBS of at least 40 k/N (8992 lbf.)

Other Connectors/Links

Trilink

- Must be closed
- Three way pull
- More durable than a carabiner

Screwlinks

- Must be rescue grade
- Often as strong or stronger than carabiners
- Very compact
- More secure
- Must be closed

Rope Grab Device System Component

Rope grabs (ascenders) –Rope grabs are designed for specific diameters and construction types of ropes. Make sure to match your rope grab with the rope being used. Lighter weight handled ascenders and chest ascenders are designed for personal ascending systems and for positioning such as an edge attendant's safety and are normally used in pairs or more. Typical MBS without damage to rope or ascender is less than 1200 lbf for most handled ascenders. It is not common to use handled ascenders in haul systems. NFPA minimum strength for light use ascenders is 5 kN (1124 lbf) without damage to the rope. General use rope grabs are often a better choice when constructing rope based mechanical advantage systems. Typical MBS without slipping or damage to the rope is less than 11 k/N (2500 lbf) for general use rope grabs.

NOTE: It is not generally acceptable to use a rope grab in a belay system to arrest an impact force!

There are rope grabs on the market designed to arrest impact forces. They are VERY specific to rope diameter and construction type. Great care should be used to make sure the correct grab is matched for the rope. They normally do not have sharp teeth and will typically slip if shock loaded until force is limited. READ the manufacturer's directions for the model you use.

Typical rope grabs

None of the typical rope grabs used are tested to NFPA standards except the PMI Progressor.

Gibbs

- Two types- free running and spring loaded
- Work well for haul cams, Progress Capture Device (PCD), etc.

Rescuescender

- Made by Petzl

- Has a “divot” in the shell

Handle ascender

- Used in conjunction with a croll or other ascending device to ascend a rope
- Has aggressive teeth
- Generally used in personal ascending systems

Croll

- Used in conjunction with the handle ascender to ascend a rope
- Has aggressive teeth
- Generally used in personal ascending systems

Prusik Hitches

There are many variables that affect prusiks and their effectiveness.

- The diameter of the accessory cord vs. the diameter of the rope should be compatible
- The hand (flexibility) of the cordage should be supple
- The hand of the rope varies the consistency of prusiks
- The material of the cord and the material of the rope can affect the consistency of prusiks
- Is the material wet or muddy
- Are they the correct length if used in pairs or with other equipment

Prusik behavior is typically inconsistent. To maximize consistency with prusik behavior we can keep a few things in mind:

- We generally use a triple wrapped prusik
- 8mm accessory cord is used with 11mm (7/16”) or 12.5mm (1/2”) rope
- Use the same material on the same material
- If used with a pulley, try to keep the prusik hitch no less than 1 inch from the edge of the pulley and preferably no more than a few inches.
- If used in pairs try to keep about 4 inches between the prusik hitches
- A single prusik is acceptable anywhere any other rope grab is utilized.
- Use tandem prusiks for belays and highlines (due to the possible impact force)
- Always keep them dressed
- Prusik lengths for tandem prusik sets are 53 inches for the short prusik and 67 inches for the long prusik, end to end, before it is tied into a loop. This works for 3 inch prusik minding pulleys.
-

NFPA 1983 MBS Requirements

- Ascender device auxiliary equipment shall withstand a minimum test load of at least 5k/N (1124lbf) without permanent damage to the device or damage to the rope.
- Rope grab auxiliary equipment designated by the manufacturer for *general use* shall withstand a minimum test load of at least 11k/N (2473lbf.) without permanent damage to the device or damage to the rope

Descent Control System Components

Descent control devices come in various shapes, size, and uses. Their purpose is basically to provide a means of applying friction within the system to control the descent of a given mass. Some have auto-stopping features while others provide minimal friction for a single rescuer. Some have VERY specific rope diameter requirements. As with the other components we must match the device with the task.

Variable versus Fixed Friction Devices

Variable
- Rack
- Petzl ID

Fixed
- Eight Plate
- Munter hitch
- Belay plates

Typical Types of Descent Control Devices
Figure 8
- Aluminum with ears
- Sport
- Twist the rope
- Easily move rope through both directions- lower and raise

Munter Hitch
- Can be used for heavier loads
- Keep the brake hand rope alongside the loaded rope to minimize rope twist
- Easily move rope through both directions (lower and raise)

Rack
Large open frame rack
- Six Bars
- Extra large top bar/hyper bar
- Straight slot second Bar
- Welded eye
- Stainless bars- less friction, heavier, more durable
- Aluminum bars- more friction, lighter, less durable

Mini Rack
- Four bars
- Hyper bar
- "U" shaped
- Small and compact
- Can control larger loads
- Has a higher MBS than the large open frame racks

NFPA 1983 MBS Requirements
- *Light use* descent control devices shall withstand a minimum test load of at least 5 k/N (1124 lbf.) without permanent damage or visible deformation to the general shape of the device or damage to the rope.
- *Light use* descent shall withstand a minimum test load of at least 13.5 k/N (3034 lbf.) without failure.
- *General use* descent control devices shall withstand a minimum test load of at least 5 k/N (1124 lbf.) without permanent damage or visible deformation to the general shape of the device or damage to the rope.
- *General use* descent shall withstand a minimum test load of at least 22k/N (4946 lbf) without failure.

Pulley System Components

There are as many types of pulleys on the market as there are carabiners and not all of them are made equally. You must know your equipment. They are made for specific rope diameters. If a rope that is too "fat" for the pulley is used it can produce so much friction that it negates the fact that you have used a pulley.

Parts of a pulley
- Cheeks (side plates)
- Sheave (wheel)
  - Tread (width of sheave)
- Axle
- Becket

There are two main types of sheaves
Bushing
- Lower efficiency than ball bearing
- 75-80% efficient
- Last longer
- No need to oil

Sealed ball bearings
- Higher efficiency than bushing
- 90-95% efficient
- No need to oil
- Ball bearing pulleys will produce a slightly more efficient haul system

Types of Pulleys
There are many types and sizes of pulleys all of which serve different purposes. Most often 2" pulleys are the smallest pulley used with larger rope to maintain efficient systems. Many of the prusik minding types are 3" and will be marginally more efficient. But you must know your sheave size. Often pulleys that look like a 3" pulley have a 2" sheave. Know what you have. It might not make that much difference but every little bit helps. The smaller pulleys may not make the most mechanically efficient systems but, in confined spaces they might be just what you need to save space.

Typical Types of Pulleys
Knot Passing Pulley
- Very large sheave so that a knot can pass through it.

Prusik Minding Pulley (PMP)
- Has square edges
- It will self mind a prusik if used correctly

Industrial Pulley
- Rounded edges
- Will not mind a prusik

Double Pulley
- Has two sheaves
- Some have beckets
- Can be used as a single pulley (connect both cheeks with the carabiner)

NFPA 1983 MBS Requirements
- *Light use* pulleys shall have a minimum tensile strength of at least 5 k/N (1124 lbf) without permanent damage to the device or damage to the rope.
- *Light use* pulleys shall have a minimum tensile strength of at least 22k/N (4946 lbf.) without failure.
- *General use* pulleys shall have a minimum tensile strength of at least 22k/N (4946 lbf.) without permanent damage to the device or damage to the rope.
- *General use* pulleys shall have a minimum tensile strength of at least 36 k/N (8093 lbf.) without failure.

Auxiliary Equipment, Systems, System Components, and Manufactured Systems
Equipment that is not specified above is fit into this category.

Examples
Swivel
- Used to prevent "hard link"
- Can prevent friction
- Adds length to system

Rigging plates

- Used to clean up rigging
- Litter spider FOCALS.
- Quick way to avoid 3 way (or more) loading of carabiners
- Adds weight and extra carabiners
- Extends the length of the system
- Typically exceed 44.5 k/N (10,000 lbf)

NFPA 1983 MBS Requirements

- Light use auxiliary equipment, systems, system components, and manufactured systems shall have a minimum tensile strength of at least 22 k/N (4946 lbf.) without failure.
- General use auxiliary equipment, systems, system components, and manufactured systems shall have a minimum tensile strength of at least 36 k/N (8093 lbf.) without failure.

Edge protection

Protection of equipment is very important. A rope over a sharp abrasive edge can be very dangerous. Placing edge protection can drastically reduce rope abrasion.

Types

- Canvas Pads – eg. PMI rope pad
- Wrap around rope protectors- eg. Raven rope guard
- Edge roller
- Fire hose
- Ultra-Pro

Harnesses

Only commercially sewn, labeled harnesses are acceptable for a rescuer.
Homemade harnesses or tied harness are emergency harnesses and should only be used as such.

> UIAA standard for harness is to hold a static load of 15kN for five minutes or more. NFPA is 22 kN (4946 lbf) plus a dynamic drop test of fall factor (FF) 1 for one meter with a 300 lbf test dummy on a cable. Fall factor is the length of a fall divided by the length of the rope available to arrest the fall. For example: a person attached to one end of a 10 foot rope at their waist tied in with the other end of the rope anchored at waist level, falls off a cliff. They will free fall 10 feet on 10 feet of rope. 10 divided by 10 is 1. A second person attached to one end of a 10 foot rope at their waist tied in with the other end of the rope anchored 10 feet below where they are standing, falls off a cliff. They will free fall 20 feet on 10 feet of rope. 20 divided by 10 is 2.

The instructor should not spend time explaining fall factors. They will be covered in-depth in the Level I & II courses.

NFPA has harness type classes. This is the only standard that uses this terminology.

- **Class I**- Single person seat harness for emergency escape
- **Class II**- Two person seat harness, meaning the harness is strong enough to hold the wearer and a second person holding on to or clipped to the harness.
- **Class III**- Full body harness. For confined space, tower rescue, or fall arrest (not fall protection)

Harness Design Considerations – Not a rescuer issue but may be a victim issue- young adults and children should wear a harness that has some sort of chest harness or full body harness to keep them from slipping out of the harness if they invert. Reason - pre pubescent bodies tend not to have sufficient hips developed for the waist band to keep them in the harness if inverted.

- User is secure so they won't fall out
- Should not be painful to sit in
- Keeps patient upright – add a chest harness if needed
- Anyone hanging motionless in a harness constitutes an emergency.
- Compartment syndrome, suffocation, and nerve damage are possible in just a few minutes if completely motionless.

Helmets

Helmets used for technical rescue applications should be specifically designed for the environment. For rope rescue is may be best to use a helmet with a suspension system. For water rescue applications be sure to use a helmet that will drain water quickly. Any helmet should meet UIAA, CE or other similar standards

Equipment Care

Equipment should be properly cared for in order to extend its lifespan. Clean, well maintained equipment not only looks good and instills pride in the team; it also ensures equipment will work properly and efficiently.

Cleaning Hardware

- In a tub with mild soap and water
- Rinse with a water hose
- Let air dry
- Do not store wet

Steel carabiners
To protect carbon and alloy steel carabiners from rusting, clean and dry them after each use to remove dirt and moisture. Apply a generous amount of a good preservative, such as LPS1, to the entire gate surface including the cross-pins, gate pivoting area and under the locking knob. Inspect the body of the carabiner for damage to the plated finish and apply preservative there also, then wipe off the surplus from all of the carabiner's exposed surfaces. We suggest LPS1 because it will penetrate into tiny spaces and get between steel surfaces and the moisture that attacks them. LPS1 is a greaseless lubricant that leaves no residue behind. This minimizes the amount of "gunk" build up on equipment and keeps things running smoothly.

Pulleys
Rescue pulleys should be cleaned, dried and checked for proper functioning of all parts after each use. The bronze bushings and ball bearings are both permanently lubricated, so no user lubrication is required. Disassembly of these pulleys in the field is not recommended by manufacturers. Any pulley that does not function properly may be returned to the manufacturer for inspection and evaluation.

Other equipment
All equipment should be cleaned after each use. Lubrication of moving parts should be done per manufacturer's recommendations. LPS1 should be applied to components that have a risk of corrosion. Software (ropes, webbing, and harnesses) should be cleaned, dried, and inspected before storage.

Litters

Flexible Litters
- Sked
  - Single grommet hole is about 400 lbf to fail
  - Rig to multiple holes per manufacturer's instructions
  - Used in conjunction with the Oregon Spine Splint (OSS)

Ridged Litters
- Ferno Model 71 - Manufacturer's maximum load rating about 600 lbf
  - Note we do not know how the Ferno Model 71 is tested to achieve their stated 600lb maximum load. It is assumed this is not the same as the breaking strength which should be several times more than the 600 lb max load rating but is unknown.
  - Slides over terrain better
  - Works well for multiple applications
- Stoke's style
  - MBS>2400 lbf
  - Does not slide well over rugged terrain

System Safety Factors

There is no given safety factor for a piece of equipment. There must be a load or force applied to it. A safety factor is basically a ratio between and MBS and a force. Now that we have an idea of what different MBS's are for various components we can use this and compare it to the force being applied to determine the Static System Safety Factor (SSSF). The term "static" is used because this ratio is determined with the system not moving. There are basically two types of safety factors:

Component to Force Ratio (CFR) - An individual component compared to a force. The force at a given point in a system may be greater than the actual load due to rigging methods.

System to Force Ratio (Static System Safety Factor (SSSF)) - This is calculated by taking the "weakest link" in the system's Component to Force Ratio. This "weak link" then becomes the SSSF!

As rescuers we must be familiar with the MBS's of the equipment we are using and how different rigging methods can affect that MBS (ex. 3-way loading a carabiner, knots in rope, etc.). SSSF's vary from system to system. We must accurately determine the SSSF and determine if that ratio is acceptable. **Typically we try to target a 7:1 SSSF**. It may not always be obtainable but this is a good ratio to shoot for. If we do not meet a 7:1 we must decide if it is enough for the task. The reality is anything above a 1:1 should hold. But 1:1 does not take into account other "noise" in the system we did not account for (wet rope, extra friction, increased load, dynamic event, etc.) so we choose to use a larger ratio to account for the unknowns. Use equipment appropriately and use rigging methods that keep forces to a minimum, or rig to account for those higher forces. We want rescuers to rig intelligently and with insight.

*Note: **NFPA does NOT require a 15:1 Safety Factor**. They do not specify any minimum Safety Factor.*

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Knots Hitches

NFPA 1006 JPR's:
5.5.1

Time:
1.5 hours

Scheduling Suggestions:
Preferably after Ropes and Devices

Materials/Equipment needed:
Audio/Visual equipment for PowerPoint
Knots PowerPoint
10' length of rope for each student
Webbing for each student
8mm Accessory Cord for each student

Instructor requirements:
1:10 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Identify parts of rope
- Demonstrate knot tying steps
- Demonstrate proficiency in tying required knots and hitches
- Identify uses for the different knots and hitches

Knots Outline

Knots Parts

- Bight
- Loop
- Round Turn

Parts of a Rope

- Working End
- Standing Part
- Running Part

Knot Tying Steps

1. Tie the knot
2. Dress the Knot
3. Tighten the Knot
4. Safety the Knot

Knots and Their Uses

A knot or hitch's ability to hold shape and function come from the bends produced when tying them. The more bend in a knot/hitch, usually the more secure it is. Many of the knots used for technical rescue inherently have sufficient bends that keep them from coming untied. Some knots and hitches do not have sufficient bends to adequately ensure the knot will not come untied. These knots, that alone are not secure, we require to have a securing knot. The typical securing knot used is the overhand. Most knots we use do not require a securing knot. It will be noted below which knots and hitches will require them. Those that do not require a securing knot should have 4-6 inches (length dependant on diameter of material) of tail.

Overhand

- Safety/Securing Knot

Square Knot **W/Safeties**

- Securing loose ends
- No significant Load

Figure 8 Stopper

- Put in end of rope
- Base for the family of 8's

Figure 8 on a Bight

- Anchor Knot
- Often used to signify the Belay line

Double Loop Figure 8
- Anchor Knot
- Load sharing anchor
- Often Used to signify the Main line

Figure 8 Follow Through
- Anchor

Figure 8 Bend
- Join two ropes of the same size

Inside Bowline **W/Safety (overhand or Yosemite)**
- Anchor
- Basket rigging

Clove Hitch **W/Safeties**
- Used in Patient Packaging
- Basket Rigging

Girth Hitch
- Used in patient packaging
- Basket rigging

Truckers Hitch W/Safety
- Used in patient packaging
- Used to secure a munter hitch

Munter Hitch
- Belay Device
- Can be used as a lowering device

Water Knot
- Joining two ends of webbing

Double Fisherman's Bend
- Joining two ropes together of unequal diameter

Butterfly
- Midline Knot
- Used for three-way loading

Triple Wrapped Prusik Hitch
- Rope Grab
- Diameter and material of Prusik should fit the rope being used

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Patient Packaging

NFPA 1006 JPR's:
5.3.1, 5.3.2, 5.3.3

Time:
3 Hours

Scheduling Suggestions:
Before Field Work

Materials/Equipment needed:
Patient packaging materials to accommodate the class size

Instructor requirements:
10:1 Student to instructor ratio

Objectives:
At the end of the lesson the rescuer should be able to:

- Define patient packaging
- Identify medical considerations when packaging a patient for transport
- Identify 5 patient packaging devices used in our system
- Demonstrate patient packaging in a Ferno
- Demonstrate patient packaging in a Stokes (or other wire type basket)
- Demonstrate patient packaging in an OSS
- Demonstrate patient packaging in a Sked
- Demonstrate the rigging of vertical and horizontal litter bridals for the SKED
- Demonstrate patient packaging in an LSP
- Carry a packaged person in a litter
- Demonstrate the use of the big wheel

Patient Packaging

Patient packaging is the preparation of an injured person for transport. Its purpose is to protect the patient from further injury and exposure during evacuation, provide for their comfort to the extent feasible, and to facilitate evacuation by making the patient easier to handle and carry.

Medical Considerations

Technical rescues are medical operations with technical intervention. We are often responding to assist someone because they are having some sort of medical issue. It is the goal of the most systems to attempt to provide the same level of care for people in special rescue situations as those found on the street corner. Remote environments often prevent this from occurring. It is up to the rescuers responding to provide the best medical care possible with the given conditions. Often this involves "wilderness medicine" or "extended medical care" approaches (improvised medical techniques with the tools available). If there are multiple patients, triaging those patients and providing care to the ones that need it most. Here are some medical considerations to highlight and address when we are packaging patients for transport:

Patient monitoring

- Level of consciousness
- ABCs
- Vitals (Pulse, Respiration, Blood Pressure, Temperature – axial, rectal)

Access

- Eating & drinking
- Adjustment of dressings
- Adjustment of splints
- Adjustment of padding
- Removal/replacement of wet/soiled materials

Considerations of prolonged immobilization

- Pain at pressure points
- Need to move
- Restriction of breathing
- Urination & bowel movements

Other medical considerations

- Suspected spinal injuries require that the patient's head, neck and body be moved as a single unit.
- Long bone fractures and large joint dislocations may keep arms and legs from being positioned in the normal position. The injured limb will need to be supported in an improvised way.
- The patient's normal body temperature needs to be maintained/managed.
  - Prevent hypothermia
  - Prevent hyperthermia

Padding void spaces
- Reduces pressure on skin surface that contact litter/lashing
  - Head
  - Shoulders
  - Buttocks
  - Groin (harness)
- Fills voids at natural curves of body
  - Neck
  - Lower back
  - Behind knees (prevents hyperextension)

Face protection
- Face shield
- Safety glasses
- Goggles

Helmet
- Offers minimal additional protection when patient is in litter
- May be source of discomfort
- May flex neck (compromise airway and/or C-spine alignment)

Transferring patient to EMS
- Keep pertinent patient information and a log of vitals with the patient for extended evacuations. A strip of tape on the basket, leg, chest, etc. may assist with this.
- One person assigned to monitor the patient and to provide a patient report to EMS or ED

Devices

There are many devices on the market that are used to package patients for transport during technical rescues. Below are some of the common ones used in our system:

Ferno
- Plastic shell with a steel bar around the outside for support
- Can be easily slid over terrain
- Can be used for vertical or horizontal litter orientation
- Can be used with the big wheel (Is not the preferred choice but can be used)

Stokes
- All steel with chicken wire and wood bottom
- Is the best choice for use with the big wheel
- Provides better back protection for the patient
- Can be used in vertical or horizontal litter orientation

Sked
- Is best used in conjunction with the Oregon Spine Splint (OSS)
- May be medically indicated for patients with pelvis injuries, tighten down to use as a compression splint
- Can be squeezed through tight spaces
- Is great for cave rescue and confined space
- Can be used for vertical and horizontal litter orientation

Oregon Spine Splint (OSS)
- Is used for spinal immobilization (stabilization)
- Very similar to the Kendricks Extrication Device (KED)
- When used with a hasty harness a patient can be hauled or lowered
- Is made to be used with the Sked

Life Safety Products (LSP) Half-back
- Used for spinal immobilization (stabilization)
- Can also be used without aluminum spine board
- Is made with built in attachment points for loading

Securing the Patient

Stations should be setup to allow all students to package patients in each device until it appears they can competently do so.

Ferno and Stokes

If spinal immobilization is indicated secure the patient in the spinal immobilization (stabilization) device, then place them in the litter with head as close to the top of the basket as possible. With patient's who are less then 5'6" there will need to be an adjustment made to accommodate a safe and ideal movement of the patient.
- Use two 20' (min. length) webbings
- Tie an overhand loop in the end just large enough to go over patients foot (try to leave footwear on)
- Put loop over patient's foot, to act as a stirrup, and tie a clove hitch or girth hitch around the rail to isolate the stirrup.
- Do the same on the other side
- Lash patient in the litter much like shoe lacing, securing the patient in three places (one "X" to keep lower extremities in, one "X" over the pelvis, and one "X" over the torso)
- Finish the lashing over the torso forming a "V" OR if required to hold the chest in place, the lashing may be finished strait across. Care must be taken not to compromise the airway.
- Secure the lashing with a truckers hitch on both pieces webbing independently. Tie off the truckers hitch with a half hitch, safety it with an overhand knot. (The same as the munter hitch)

Litter Bridals will be covered in the Hauls and Lowers Class

OSS
- Secure the OSS on the patient per the manufactures recommendations
- Secure the chest straps first (straps are color coded)
- Secure the abdominal straps
- Secure the Ischial (leg) straps
- Secure the head
- Torso straps can go across the chest to match their color coding or can be secured around the shoulder in case of a clavicle injury

Sked

- It is preferred to have the patient in an OSS (with shoulder board) or on a backboard
- Attempt to leave patient's footwear on to protect the patient's feet
- Place the patient on the Sked with shoulders about even with grommets through the middle of the Sked
- Cinch straps straight across the device (do not make "X's" as this is not recommended by the manufacture.), keeping in mind airway concerns *(overhand knots on the straps are NOT recommended)*
- Bring the foot flap up and run straps through associated grommet and cinch down *(overhand knots on the straps are NOT recommended)*

Vertical Bridal

- Find the middle of the 10mm vertical bridal rope and tie a butterfly or a figure eight on a bight
- Run the rope through the grommets out-side-in until the last two grommets and run them inside-out
- Tie a square knot
- Safety the square knot at end of the Sked or extend the tails up toward the patients knees and pass the ends through the litters handles and tie another square knot with overhand safeties

Horizontal Bridals

- Using the yellow straps provided pass them through the slots cut in the plastic that are angled.

LSP (Half Back)

- Place around the patient and connect buckles to their respective connectors
- If being used for vertical lift, attach the spreader bar or use webbing to improvise a harness to attach to the front vertical attachment points. Webbing should not allow a cinching action across the patient's chest.

Big Wheel

- Can be placed on the Ferno or the Stokes but fits best on the Stokes
- The key is to push down on the litter and not pull up
- Eases the difficulty of extended walk-outs

Litter Movement

Give the students the opportunity to practice carrying the different litters. At a minimum all students should do the following:

- Carry a patient a minimum of 100 feet in each litter
- Use 4 and 6 person carries
- Attach a litter to a big wheel and move a patient a minimum of 100 feet
- If location and time permits possibly set up an obstacle course to simulate moving the litter over rugged terrain

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Anchors

NFPA 1006 JPR's:
5.5.2

Time:
30 Minutes

Scheduling Suggestions:
After Knots, Hitches and Harnesses
Before Raising and Lowering Systems

Materials/Equipment needed:
Audio/Visual equipment to display power points
Anchors power point
Rope, webbing, anchor strap, carabiners

Instructor requirements:
1:10 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Identify suitable anchor points
- Demonstrate knowledge of anchoring rules
- Demonstrate building anchors

Anchoring

Anchor Points

The only anchoring method taught in the General Rescuer course is single point anchor systems. It must be stressed that all anchors used at this level must be strong and bombproof. Great effort should be made to ensure students can select appropriate single point anchors. Pre-tension back ties, multi point anchors, and other anchoring methods will be taught during the Level I and II courses.

Bombproof defined: An anchor, which if failed, would cause a significant structural collapse

- Structural Concrete
- Structural Steel
- Large live tree
- Off side of vehicle

Questionable

- When in doubt back it up (Should not be in doubt during GR)
- Secondary anchor must be as strong or stronger

Improper Anchors

- Insulated Pipes
- Cast Iron Pipes
- Aluminum Handrails
- Lightweight Metal
- Brick Veneer
- Dead Trees
- Loose Rock

Anchoring Rules

- Strongest part of the system
- Back up questionable anchors
- Keep angles at 120 degrees or less
- Pad sharp or rough edges
- Rig high

Anchors

- Tensionless Hitch
- Looped Knot
- Webbing looped and doubled (AKA- Basket, 3 Bight)
- Utility Strap
- Wrap three pull two (Level I and II)
- Load Sharing (Level I and II)
- Load Equalizing (Level I and II)

Anchor extensions

At times it may be appropriate to use an anchor a distance from the work area and extend it from there closer to the work area.

- Single strand of rope

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Belay Systems

NFPA 1006 JPR's:
5.5.11, 5.5.12

Time:
30 Minutes

Scheduling Suggestions:
Before any technical work is done

Materials/Equipment needed:
Equipment for the class to build systems

Instructor requirements:
10:1 Student to Instructor Ratio

Objectives:
At the end of the training the rescuer should be able to:

- Define belay systems
- Describe four common types of belay systems
- Identify two types of top belays
- Describe six characteristics of a Munter hitch belay
- Demonstrate tying off a Munter hitch
- Identify eight considerations of top belays
- Identify the parts of a top belay
- Recite the belay commands

Belay systems

Belay Systems are defined as systems employed to safeguard the load in the event that the main means of supporting it is rendered ineffective. Some examples of that would be: damaging equipment, human error, etc. It is common to attempt to have two ropes attached to a load when being supported by rope based systems. Sometimes this is by means of a "Two Tensioned Rope System" (two mainline systems attached to the load) other times this is done by means of a single tensioned main-line and an un-tensioned belay line. There are many methods for belaying a load and belays may not be required 100% of the time, though it is common to belay most loads. It is paramount, if a belay system is utilized, that it be able to safeguard the hazard in which it was designed to belay. Often this means that the system be required to arrest an impact force from a falling load. Here are some types of belay systems:

Self Belay

This is when methods are utilized to safeguard you. Some examples of this would be:

- Attaching to a local anchor
- Tending a friction hitch (attached to the same rope that is supporting you or to a separate rope) during a rappel, raise, or lower

Lead Belay

This system is typically used in "bottom up" rescues (towers, taller rock walls with no top access, etc.) The climber climbs up and periodically places intermediate anchor points and attaches a rope to them. With this type of belay high Fall Factors may be produced and in turn high impact forces can be present. This is why dynamic rope is often the best choice for lead belay systems.

Bottom Belay

This is when someone is at the bottom of a fixed rope rappel or "traveling break" lower. Their job has two parts:

1. Pull down on the rope; this will act as the break hand for the person traveling down line.
2. Pull the end of the rope away from the plumb line. This will make the distance from the load to the "Bottom Belay-man" further than the distance from the load to the ground, making it difficult for the load to reach the ground.

Top Belay

This is the most typical type of belay employed in rescue. This is accomplished by attaching a redundant un-tensioned rope to the load that is run through a belay device. This rope is generally left unloaded during an operation and only utilized in the event that the main load supporting system is rendered ineffective. Often when this belay is actuated the load produces an impact force on that rope and belay system. Great effort should be made to ensure that the belay method chosen is capable of arresting that impact force.

Two Common Top Belay Methods

Munter Hitch Belay

(This is the only belay method to be used during the General Rescuer Course)

This belay utilizes the friction from the Munter hitch (often called the Italian hitch) to arrest the impact force produced by the load. Munter hitches are typically used for lighter loads (<300 lb) but if tended correctly, and a moderate amount of edge friction is present to absorb some of the impact force, it is possible to belay heavier loads (<600 lb). This belay requires the belayer to maintain control of the brake rope in order for this belay to be effective. Some characteristics of this belay are:

- Fast set up
- Minimal equipment
- Effective
- Requires rescuer interaction
- A Munter hitch is best used in conjunction with an XL Carabiner
- To go hands free tie off with a half hitch followed by an overhand

Tandem Triple Wrapped Prusik Belay (TTPB)

(This belay method should only be touched on and should not be used during the General Rescuer class. This belay will be covered in the Level I & II course)

This belay utilizes two prusik hitches sized, matched, and tended appropriately to catch the impact force. This belay is a quirky belay system that requires constant maintenance. The TTPB, if tended appropriately, is capable of arresting the impact forces produced by heavier loads (600 lb, possibly more).

Some characteristics of this belay are:

- Can be hands free for short durations
- Requires more practice operating to become proficient
- Requires that the prusiks be sized and dressed appropriately to maximize effectiveness
- Requires rescuer interaction
- Can use PMP during a raising operation to keep line slightly tensioned

Operation during lowering evolution:

- Strip rope through prusiks in short bights, never allowing more than one foot of slack to develop.
- Keep prusiks at 90 degree angle to belay line's direction of travel.
- Keep system components between prusiks and anchor snug (don't allow them to sag).
- In the event of an actuation, the prusiks are "locked up"; there should be a plan to overcome this. Typically a Load Releasing Hitch (LRH) is used in conjunction with the TTPB.

BELAYING DURING A LOWERING OPERATION IS A DIFFICULT JOB, AND MUST BE TAKEN ABSOLUTELY SERIOUSLY.

Parts of a Top Belay

- Anchor
- Rope
- Belay device
- Belayer
- Load

Top Belay considerations:

- Be aware where your body is in relation to the belay system. If the rope gets loaded where is it going to go?
- If a directional is needed, avoid using pulleys. Instead run the rope through a carabiner to provide friction.
- Avoid running belays through high-point.
- Rig the belay where it can be easily operated
- To keep redundancy, rig belays on separate anchor points. If an anchor point is exceptionally bombproof the same point may be used. However students should rig separate anchor systems for the main system and the belay system.
- Try and rig belays somewhere around 10 ft. from the edge and as inline with the main-line as possible. This will ensure adequate communication, room for on- and off-loading, and prevent any drastic load shift in the event of an actuation
- Pad the edge if indicated
- If attaching belays to a person in a harness, the Belay should be attached to the front attachment point. No belay should be attached to the dorsal or back attachment on a harness. (The only exception would be for an emergency retrieval system in Confined Space work)

Commands

As with any operation, standardized commands can increase efficacy. Before operating any system a "Role Call" should be conducted. The "Role Call" Command applies to any operation (i.e. Lower, Raise, Belay etc.). A System Safety Check should be done either just prior to the role call or finished before the role call is complete.

Before any system is used the person in charge should start the operation by loudly saying **"ROLE CALL",** followed by a ready check (role call) of each position (i.e. brake-man, belay-man, edge tenders, haul team, tag lines, etc.).

Once the role call is complete, the command **"Position the Load"** should be used to direct the team members to move the load in a position to be hauled or lowered.

Once the load is into position, the command **"Load the System"** will be used to suspend the load by the ropes.

Example:
Squad Leader- "ROLE CALL" (everyone should stop talking and listen to the leader)

Squad Leader- "Blue Line Ready?"
Blue Line Operator- "Blue Line Ready!"

Squad Leader- "Red Line Ready?"… (Leader should check the readiness of all positions)
Red Line Operator- "Red Line Ready"…(All positions should respond with their readiness)

Squad Leader- "Position the Load" (The load should move into position)

Squad Leader- "Load the System" (The load should be suspended by the ropes)

Squad Leader- "Slow Haul", "Slow Lower", etc. (Direct the operation)

Other Standardized Commands
Often when belaying, the commands below may need to be used. An example of this would be when belaying a person rappelling.

- On Belay- This is a question to the belay-man to ensure he/she is ready to belay
- Belay On- Is the answer from the belay-man confirming he/she is prepared to belay.
- Off Belay- Term used to let the belay-man know the belay is no longer needed
- Belay Off- Used to confirm the belay is no longer in operation
- Stop- Used by anyone in the operation to suspend action
- Slack- A request for slack
- Tension- A request for tension

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Raising and Lowering Systems

NFPA 1006 JPR's:
5.5.4, 5.5.8

Time:
3 Hours

Scheduling Suggestions:
After Ropes and Devices, and Patient Packaging

Materials/Equipment needed:
Equipment necessary to construct raising and lowering systems
A site that will accommodate students and provide a place to build and use the systems

Instructor requirements:
1:5 Instructor to student ratio

Objectives:
At the end of the training the rescuer should be able to:

- Describe the two primary vertical system techniques
- Define a lowering system
- Describe the parts of a Two Tensioned Rope System- lowering system
- Identify lowering considerations
- Define mechanical advantage
- Identify three methods for calculating mechanical advantage
- Describe simple mechanical advantage
- Describe the parts of a Two Tensioned Rope System- raising system
- Identify raising system considerations
- Identify standardized commands
- Describe important points concerning litter work

Vertical Systems

There are two primary vertical system techniques.

1. Two Tensioned Rope Systems (TTRS) that utilize two ropes attached to the load and they share the load equally.
2. Single Tensioned Main line with an Un-tensioned Belay System (STM-UTB). One rope supports the load and the other is only loaded in the event the main load supporting system is rendered ineffective.

Both techniques use two ropes to support the load and provide redundancy. Both systems can be very effective. It is the goal of this course to provide simple, retainable, reproducible systems. We will focus primarily on TTRS and briefly hit on STM-UTB systems.

Lowering systems

A lowering system is defined as a means to control the lowering of a load to a destination using a rope.

Two Tensioned Rope Systems (TTRS)

During a lower, effort should be made to allow both ropes to share the load equally. In the event that one of the two ropes is rendered ineffective, the load would shift onto the other rope and there would be no impact force.

Parts of a TTRS lowering system

- Two anchors - As close together as possible. It may be desirable to have them on separate anchor points for redundancy.
- Two descent control devices- Typically use the same type of device on both lines. During the GR class, munter hitches will be used
- Two brake tenders- This is the rescuers tending the friction devices

Single Tensioned Main – Un-tensioned Belay (STM-UTB)

Only one rope is loaded and acts as the “elevator line” commonly referred to as the Main Line. The other rope attached to the load is a Belay. The belay is typically not loaded unless the Main Line is rendered ineffective.

Parts of a STM-UTB Lowering System

- Mainline- Supports the load
- Brake tender- This is the rescuer tending the friction device
- Belay system- Acts as a redundant system that will catch the impact force produced by the falling load. (ex. Munter Hitch, Tandem Triple Wrapped Prusik Belay)
- Belay tender- The rescuer operating the belay

Lowering Considerations

- Rig where the brake tender can work safely and effectively
- Rig where communication is facilitated
- Give the litter room for a good resting place at the top. 10’ of space is a good objective

- Protect the rope at friction points
- Rig where you are less likely to drop things on the patient (avoid crumbly edges, etc.)
- Rig where getting the litter over the edge will be as easy and safe as possible
- Use a high directional if it's available
- Rig the litter before it is sent to the rescuers (see litter rigging considerations)

Mechanical Advantage Systems or Haul Systems

Mechanical Advantage (MA) is defined as the ratio of tension at the load compared to the force required to move it. There are many types of haul systems and each rescue will require a unique system for that rescue.

How MA Works

- Work = Force x Distance- The amount of force required to raise a load is less but more rope is required to be moved through the system to equal the same amount of work. So with a 4:1 for every 4 feet of rope pulled by the haul team the load only travels 1 foot.

- For a simple system the number of ropes that support the load share the load equally. This includes the line that we pull on. So we hold a fraction of the load in that one line and the other lines and the anchor gets the rest.

Methods for calculating MA

- Ideal Mechanical Advantage (IMA)- Calculated without consideration of friction or other losses of advantage
- Theoretical Mechanical Advantage (TMA)- Calculated using an expected value for friction and other losses of advantage
- Actual Mechanical Advantage (AMA)- Measured directly under actual field conditions

Types of MA

Simple Systems

- All traveling pulleys move toward the anchor at the same rate of speed.
- Is one system working on itself
- Counting the number of ropes at the load will determine the MA ratio

Examples of simple systems

- 1:1 (Georgia haul)
- Block and tackle systems (4:1 & 5:1)
- 3:1 z-rig (for use in low-angle)
- Counter balance (to be taught during low-angle)

Compound Systems

- Any combination of two or more simple systems acting on each other forms a compound system.
- To determine the MA of a compound system, multiply the MA ratios of all the systems working on each other. 5:1 acting on a 3:1 = 15:1
- Traveling pulleys will move toward the anchor but not necessarily at the same speed
- Having the greater MA system working on a smaller MA results in fewer resets

Examples of compound systems

- 4:1 pig rig

Complex Systems

These are systems that do not follow the rules of either the simple or the compound systems. Complex systems may have pulleys moving in different directions and may be moving toward the load.

Different Haul System Configurations

Inline

- Uses the mainline to construct the haul system
- Z-Rig

Piggyback

- Uses a separate rope to construct the haul system and is then attached (piggybacked) onto the mainline.
- Attach to the mainline with a rope grab device (single Prusik, Rescucender, or Gibbs); this is often called the **Haul Cam**
- Block and Tackle

Parts of a Raising System

- Anchor(s)
- Two ropes attached to the load (either TTRS or STM-UTB)
- Mechanical advantage system
- Progress capture device (PCD)
- Haul team

Progress Capture Device

A progress capture device (PCD) is a component that captures the progress of the haul system. When the load is raised a distance, the PCD will hold the load at that point until the rescuer: resets the system, continues the haul, lowers the load, or whatever is needed during the evolution. Examples of some PCDs are: Gibbs, Rescucender, Single Prusik, Munter Hitch, Eight Plate, etc.

Two Tensioned Rope Systems (TTRS)

To actually have a TTRS during a raise, a haul system would need to be used on both ropes (one each) supporting the load. Effort should be made to allow both ropes to share the load equally. In the event that one of the two ropes is rendered ineffective, the load would shift onto the other rope and there would be no impact force.

Parts of a TTRS Raising System

- Two Anchors- As close together as possible. It may be desirable to have them on separate anchor points for redundancy or use rigging methods that would produce a redundant bombproof anchor (multi-point anchor, Level I and II).
- Two PCD's- Typically use the same type of device for both. Preferably one that goes "both ways" to make it easier to switch to a lower. (Ex. Munter Hitch, Eight Plate, etc…) though a rope grab would work it may be more efficient to have a device that allows you to lower should the need arise.
- Two PCD tenders
- Two haul teams- This will maintain a TTRS. This method allows for more force to be directed toward the load without overloading components. It will also allow you to overcome higher amounts of friction for edges that produce a lot of friction.

Note: The same set up could be used with one Haul System making it a STM-UTB, but the PCD method must be able to act as a belay for the load.

Single Tensioned Main – Un-tensioned Belay (STM-UTB)

Only one rope is loaded and acts as the "elevator line" commonly referred to as the Main Line. The other rope attached to the load is a Belay. The belay is typically not loaded unless the Main Line is rendered ineffective.

Parts of a STM-UTB Lowering System

- Mainline- Supports the load (could be an inline Z-Rig, or a piggyback system attached to the mainline)
- PCD on the Mainline
- Belay system- Acts as a redundant system that will catch the impact force produced by the falling load (ex. Munter Hitch, Tandem Triple Wrapped Prusik Belay)

Raising System Considerations

- Rig where haul team has room to work
- Rig where haul team can use gravity to their advantage (use a change of direction if needed)
- Rig where haul team can work safely
- Give the litter room for a good "landing", 10' of landing space is a good objective
- Minimize friction and protect the rope at friction points
- Use compact knots (small bights)
- Rig to maximize haul length (and minimize the number of resets)
- Avoid over-rigging— use the least complex system that will do the job
- Plan for the edge problem- this is often the most difficult part of a raising operation
- Rig high help if possible- this minimizes friction and helps solve edge problems
- Use Tag lines to keep the load away from obstacles
- Only use litter tenders if absolutely necessary
- Use edge tenders to assist in solving edge problems
- Rig the litter before it is sent to the rescuers (see litter rigging considerations)

Commands

As with any operation, standardized commands can increase efficacy. Before operating any system a "Role Call" should be conducted. The "Role Call" Command applies to any operation (i.e. Lower, Raise, Belay etc.). A System Safety Check should be done either just prior to the role call or finished before the role call is complete.

Before any system is used the person in charge should start the operation by loudly saying **"ROLE CALL",** followed by a ready check (role call) of each position (i.e. brake-man, belay-man, edge tenders, haul team, tag lines, etc.).

Once the role call is complete, the command **"Position the Load"** should be used to direct the team members to move the load in a position to be hauled or lowered.

Once the load is into position, the command **"Load the System"** will be used to suspend the load by the ropes.

Example:
Squad Leader- "ROLE CALL" (everyone should stop talking and listen to the leader)

Squad Leader- "Blue Line Ready?"
Blue Line Operator- "Blue Line Ready!"

Squad Leader- "Red Line Ready?"… (Leader should check the readiness of all positions)
Red Line Operator- "Red Line Ready"…(All positions should respond with their readiness)

Squad Leader- "Position the Load" (The load should move into position)

Squad Leader- "Load the System" (The load should be suspended by the ropes)

Squad Leader- "Slow Haul", "Slow Lower", etc. (Direct the operation)

Other Standardized Commands

- On Belay- This is a question to the belay-man to ensure he/she is ready to belay
- Belay On- Is the answer from the belay-man confirming he/she is prepared to belay.
- Off Belay- Term used to let the belay-man know the belay is no longer needed
- Belay Off- Used to confirm the belay is no longer in operation
- Stop- Used by anyone in the operation to suspend action
- Slack- A request for slack
- Tension- A request for tension

Lowering Commands

- Slow lower- Used to tell the brake tender to release rope to lower the load
- Slow haul – Used to direct the haul team to start a haul

Haul Commands

- Haul or Slow Haul- Used to direct the haul team to start a haul
- Stop- Used to stop the hauling process for any reason
- Set- Set the PCD
- Reset- Reset the haul system

Attaching Systems to the Litter

Litter Orientation

Horizontal

- Almost always complicates edge negotiation
- Generally better for the patient
- Uses bridals for main and belay line connections to litter

Vertical

- Often the only option in narrow passage
- Dramatically simplifies edge negotiation
- May be uncomfortable or dangerous for patient if left hanging (could result in harness hang syndrome unless foot stirrups are used)
- Often allows such swift completion of the raising/lowering operation that the patient can tolerate it with ease
- Can use bridle at head of litter for main and belay line connections
- May connect to the head of the litter with one line and a second line to a low point connection for edge negotiation.

Litter Rigging

Horizontal

- Use the Yosemite Bridles
- Connect both lines to the focal point with Figure eight, Double loop figure eight, long tail bowline (typically for a litter tender), Butterfly with tail (typically for a litter tender).
- Use a Tri-link to connect both ropes to the Yosemite Bridals. Or the use of one or two carabineers at the focal is acceptable.

Vertical

Head of basket

- Yosemite to the head
- Two clove hitches and a bowline with the end of the rope
- Doubled webbing (typically a single strand of webbing would not be adequate)

Low point litter rigging

- Two long prussic loops, one from each side, to a tri-link to the back for a low-point attachment (the long prusik from a tandem prusik set works well)
    - Keep the double fisherman's knot close to the litter handles to reduce the chance of them catching on objects under the litter

Litter Rigging Considerations

- Rig the litter before it is sent to the rescuers.
    - Insures that the litter is rigged properly for the type of system being used (Horizontal, vertical, low point attachment, etc.)
    - Reduces the workload of the rescuers tending to the patient
- Patient injuries (Horizontal or Vertical)
- Environment (Narrow passages, vegetation, industrial)

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING

R.E.S.E.T.

General Rescuer Course

Class Title:
Non-Verbal Communication

NFPA 1006 JPR's:
5.2.4, 5.2.6

Time:
10-15 min.

Scheduling Suggestions:
Just prior to Hauls & Lowers Day 2 pm.

Materials/Equipment needed:
Classroom/Field:
Flashlight
Whistle
Rope
*optional Audio/Visual equipment for PowerPoint
Dry Erase/markers

Instructor requirements:
Classroom
1:30 Instructor to Student Ratio

Objectives:
At the end of this lesson the rescuer should be able to:

- Recognize and verbalize three situations where verbal communication would not be effective or understood at an emergency incident.
- Using a rope and with an assistant demonstrate the O-A-T-H system by pulling on the rope.
- Demonstrate three hand and arm signals without any voice communications

Introduction:

An incident scene can have multiple communication barriers. For example, communication barriers could be environmental noise (e.g. emergency apparatus, people), visibility limitations (e.g. time of day), and natural barriers (e.g. cliff, crack and crevice). Rescuers and rescue teams should have alternative forms of communications (other than voice) to communicate with each other and successfully complete tasks. Instances where this maybe need are as follows:

- A rescue team leader directing rope operations that may be in & out of effective voice communication (e.g. directing rope operation on high-rise building),
- A rescuer working out of effective voice communications (e.g. litter attendant with patient that is mid-face on a cliff),
- Swift water operation (e.g. swift water technicians that far downstream from each other)
- During confined Space Operations (e.g. entrant has radio difficulties and needs help).

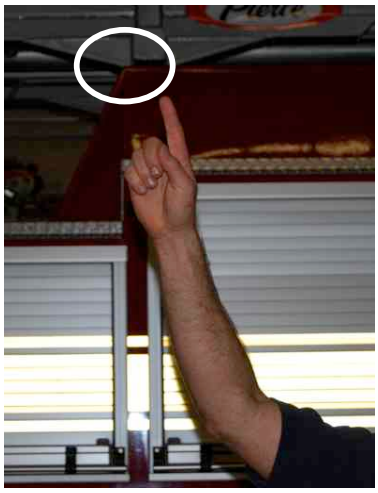
Rescue teams are encouraged to adopt these signals and even develop their own to use during rescue operations. Every member of the team should be clear what signals mean. Furthermore, if team leaders/ rescuers are using hand signals, it is a good idea to have someone actively watching and not running a piece of equipment. They can relay the signal immediately and rescue operations will happen without delay.

Communication Mediums (other than voice) and Techniques:

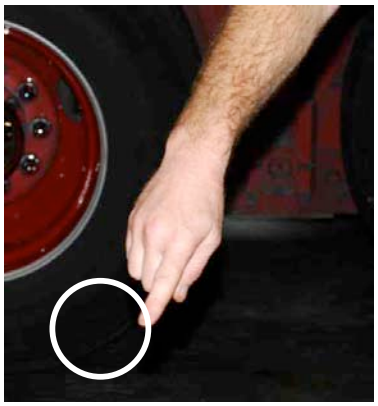
- Using hand and arm signals (some of these signals are borrowed from Power Crane Association PCA of New Zealand)

"OK"- I am OK. Everything is Ok.
(Description: Fingers of one hand pointing straight out and touching top of head, arm forms circle)

“NOT OK”/”There is a Problem”
(Description: Fingers of one hand extended, one arm extended parallel with ground, make a horizontal slashing move across your throat.)



“Haul”/”UP” (Slow Haul) with the system
(Description: With arm extended up and index finger pointing up, move arm in horizontal circles.



“Lower”/Down (Slow lower) with the system
(Description: With arm extended down and index finger pointing down, move arm in horizontal circles.

“STOP”
(Description: Form a fist in both hands, cross forearms in front of your face.)

"On Ground, Operations complete"-Patient and/or Rescuer is/are on the ground safely. (Description: Place arms on head, making a circle, and cross hands.)

- **Using Rope = The O-A-T-H System**

  Note message is sent from one direction at a time (from sender to receiver or vice versa) with a reply in some instances. For example, a confined space attendant may pull on a rescuer's safety line once to ask "Are you 'OK'". The rescuer will return with one pull of his safety line "I am 'OK'". Furthermore, that same rescuer may pull his safety line twice to tell the attendant to allow slack in his safety line. The attendant will reply with one pull signaling message received and slack will be given. Firm deliberate pulls are imperative. Rope running around edges can mimic rope pulls.

  O= 1 Pull of the rope. "**OK**"= I am "Ok" and/or Message received

  A= 2 Pulls of the rope. "**Allow Slack**" = Let out rope.

  T= 3 Pulls of the rope. "**Tension Line**" = Take up rope.

  H= 4 Pulls of the rope. "**Help**"= There is a life threatening event, BIG PROBLEM
  * USUALLY the rope is pulled repeatedly.

FOR INFORMATION ONLY

- **Whistle/Horn Blasts:**

  One Whistle/horn Blast- Look upstream and/or "Hey, I need your attention".

  Two Whistle/horn Blasts- Look Downstream and/or "Hey, I need your attention".

  Three Whistle/horn Blasts (REPEATED)- "Help" Distress. The Austin Fire department Use this as a message to firefighters to evacuate a structure when radio communications have failed

- **Light**

Light obviously can be used to illuminate hand signals. Scuba diver's point light sources to the sea floor and move it certain directions to communicate.

Light (pointed to ground) moved in circular motion = I am "Ok" and/or Are you "OK"

- **Marking Tape**

Occasionally marking tape is used to mark searched areas. For example, a search team will use piece of marking tape with a time, date and name written on it to denote that a search party has searched a certain area. This will alert future parties and even lost victims that a search party has been there. Marking tape can be left at trail heads or passages for visual recognition that a search party has been there.

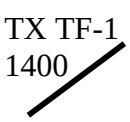
- **Search Marking System: Structure/Hazards Marking System**

A standardized marking system to identify structures in a specific area and any hazards found within or near the structure. The structure triage, assessment and marking system is intended to be the National Standard system for evaluating, identifying, and marking buildings. It is designed to help identify, select and prioritize the buildings with the largest probability of success with respect to finding and rescuing victims.

It is important that information related to building identification, conditions, hazards and victim status are posted in a standardized fashion. The theme of search & rescue must be to save trapped victims while minimizing the risk to the victim and the rescue forces.

A 2 foot x 2 foot square box is outlined at any entrance accessible for entry into any structure. Aerosol cans of International Orange spray paint are to be used for this purpose.

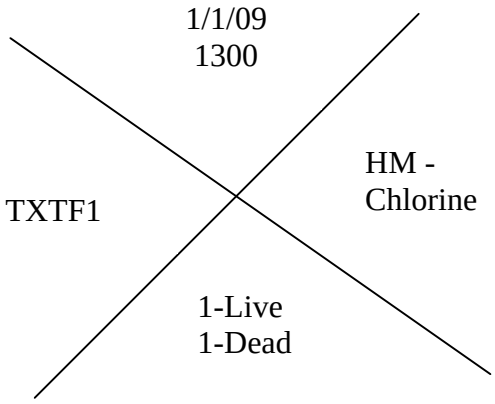
An arrow should be placed next to the 2’ x 2’ orange box indicating the direction of the safe entrance, unless the entrance is next to the orange box.



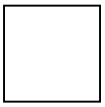
Search operations are currently in progress. (ORANGE)
Time and Task Force Number are posted.

Personnel have exited the structure. (ORANGE)

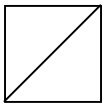
Distinct markings will be made inside the four quadrants of the X to clearly denote the search status and findings at the time of this assessment.



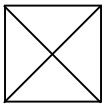
Left quadrant – Team identifier.
Top quadrant – Time and date team left the structure.
Right quadrant – Hazards found.
Bottom Quadrant - Number of live and dead victims still inside the structure. *Written in Black Marker or lumber crayon/chalk*



Damage is minor with little danger of further collapse. Structure is safe for search and rescue operations.



Damage is significant. Shoring, bracing or removal of hazards is necessary.



Structure is not safe for search and rescue operations. Remote search operations may proceed at significant risk. Safe havens and evacuation routes should be established.

Direction to safely enter building.

Source: Federal Emergency Management Agency Urban Search and Rescue Task Force System.

This will be covered more in depth in future training you may encounter.

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Introduction to Vertical Hauls and Lowers Field Work

NFPA 1006 JPR's:
5.5.4, 5.5.6, 5.5.8, 5.5.10, 5.5.12

Time:
4 Hours

Scheduling Suggestions:
After Anchors, Hauls, Lowers, Belays etc…

Materials/Equipment needed:
All the equipment to conduct haul and lowering evolutions

Instructor requirements:
5:1 Student to Instructor Ratio

Objectives:
At the end of this field session the student should be able to:

- Demonstrate the rigging and operation of a Two Tensioned Rope System - lower
- Demonstrate the rigging and operation of a 1:1
- Demonstrate rigging and operation of a 4:1/5:1 block and tackle
- Demonstrate rigging and operation of a Munter hitch belay
- Demonstrate the rigging and operation of a Single Tensioned Main Un-tensioned Belay System - raise
- Demonstrate the rigging and operation of a Two Tensioned Rope System – raise
- Demonstrate edge tending by tying in short
- Demonstrate the uses of effective line vectoring

Introduction to Hauls and Lowers

This would be best done at a site where anchors are plentiful and the area is conducive to instruction. Several stations should be set up to accommodate the number of students. The instructors should direct all evolutions during this session.

Edge Tending

At times it may be required for rescuers to travel to an edge that would expose them to a fall hazard. Means should be employed to safeguard rescuers from this hazard. The method to be used at the General Rescuer level is to use a travel restriction system. The method used will be referred to as being "Tied in Short". The rescuer should **NOT** go over an edge and use this system to support their weight. It is only intended to prevent the rescuer from falling in the event of a slip.

1. The rescuer will plum the edge for desired length on the edge line that is tied off life safety to a suitable anchor
2. The Rescuer will then tie a figure 8 into the edge side of the rope; the rescuer will then attach the figure 8 directly to his or her harness.
3. Next the rescuer will attach a prussic loop onto the edge line, and then attach the loop end of the prussic to the same carabineer used to attach the figure 8 knot to the harness. The rescuer is now tied in short. He or she may move up and down the edge line safely.

Line Vectors

The use of line vectors in the rope rescue environment is a very useful tool. By applying force into a loaded line a rescuer can change the path or height of a load. This technique allows us to move a pt the last few critical feet over an edge or around an obstacle. A line vector can also be used to reduce edge friction by vectoring the rope away from friction points.

At a minimum the following evolutions should be conducted:

- A Two Tensioned Rope System (TTRS) lower using two Munter hitches
- A Single Tensioned Main Un-tensioned Belay (STM-UTB) raising system using a 1:1 with a Munter hitch as a PCD and a Munter hitch Belay
- A STM-UTB raise using two Munter hitches and a 4:1/5:1 Block and Tackle
- A TTRS Raise using two Block and Tackles, one on each rope with Munter hitch PCD's
- Demonstrate the use of line vectors

The first several evolutions should use a person in a harness and appropriate PPE. Both ropes should be attached to the front waist attachment point on the harness. *No rope should be attached to the dorsal or back attachment on a harness.*

All evolutions should be centered on the use of two Munter hitches and a 4:1/5:1 Block and Tackle to be attached to either rope (Except the 1:1 evolution). High help should be used to solve the edge problem for these evolutions. Low edge problems will be introduced in the High Angle Field Work lesson. If time permits some basket work[1] can be introduced. Use tag lines to control the litter.

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Belay a Falling Load

NFPA 1006 JPR's:
5.5.13

Time:
2 Hours +/- depending on class size

Scheduling Suggestions:
After the students have had the opportunity to operate belay systems in the field

Materials/Equipment needed:
Rope and equipment to set up belay systems that is either out of service or will be taken out of service after this lesson

Instructor requirements:
1:10 Instructor to Student Ratio

Objectives:
At the end of this Lesson the rescuer should be able to:

- Describe the purpose of a belay
- Successfully catch a falling load
- Demonstrate tying off a munter hitch under load

The Purpose of a Belay

Un-tensioned belay systems are commonly used in rope rescue operations. It is paramount that if rescuers use an un-tensioned belay system that they ensure it will work as intended. Often this means that it will be capable of catching an impact force. This impact force would be produced by the rapid loading of the rope by the load that was supported by another system.

Impact Force (AKA Shock load) - The rapid deceleration of a falling load (like those seen in a belay line actuation).

Be sure that the belay system selected will safe guard the hazard in which the belay was intended to protect.

In the General Rescuer Course we are focusing primarily on single person (lighter weight) loads. The only belay utilized will be the Munter hitch belay.

Catch a Falling Load

A station(s) should be built to allow a Munter hitch belay to be operated by the student. The rope should run from the Munter to a location where a minimum of a 300 lb. load can be raised, allowing the student to operate the Munter hitch for a short time, and the load can be dropped onto the belay system producing an impact force that the student would have to arrest. The rope should run over an edge or a simulated edge such as a carabiner.

Each student should successfully catch a falling load with a Munter hitch.

Tying off the Munter Hitch

Tying off a munter hitch is a skill that each rescuer must master. Often in the field this is required to be accomplished with a load on the system. During this exercise each student should be required to successfully tie off the munter hitch, with a half hitch followed by an overhand, while the system is loaded after the belay drop.

Roll Call

The “Roll Call” commands help the communication process when employing a rescue system. For someone who is new to the “Roll Call” it takes practice to remember the order and specific terms used. The falling load exercise is an excellent opportunity for each student to practice these commands in a practical situation. Opportunity should be provided to allow each student to use the “Roll Call” and direct an operation. Refer to the hauls and lowers lesson for the “Roll Call” commands.

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
Low-angle Field Work

NFPA 1006 JPR's:
5.5.5, 5.5.7, 5.5.9

Time:
6 Hours

Scheduling Suggestions:
After Raising and Lowering Systems

Materials/Equipment needed:
Equipment to accommodate the students for low-angle field evolutions

Instructor requirements:
1:5 Instructor to Student Ratio

Objectives:
At the end of the lesson the rescuer should be able to:

- Define low-angle
- Demonstrate appropriate patient access techniques
- Demonstrate anchor rigging
- Build and operate a Munter lowering system
- Build and operate 4 types of low-angle raising systems
- Demonstrate low-angle litter attending
- Identify litters best used in the low-angle environment

Low-angle

Low-angle is defined as slopes of 40 degrees or less. A good rule of thumb would be if you can walk up the slope without assistance then it is probably a low-angle environment. On low-angle slopes it is often necessary to attach one or two ropes to a litter to assist maintaining control during transport.

Patient access

When attempting to access the patient, it is best to do so from an area not directly above the patient. Access may be impeded by trees or brush therefore it may be necessary to bring saws. Technical rescues are "medical operations with technical intervention" so do not forget to bring the medical gear.

Anchors

Time should be spent identifying suitable anchors for this environment. Allow time for the students to build anchor systems. Keep in mind the following:

- Big Friendly Trees "BFT"
- Vehicles
- Big Friendly Rock "BFR"
- Rig high if possible
- Use anchors that maximize efficiency

Lowering and Raising Systems

When raising and lowering a patient in the low-angle environment only one rope is usually needed. The rescuers attending the litter with their hands on the basket is considered one point of attachment, and the rescuers feet on the ground is considered the second point of attachment, provide a means of controlling the litter from sliding down the slope.

Lowering

Use a Munter hitch to control the load.

Raising

When moving the litter it is usually moved in one of two ways. The litter attendants carry the litter up the slope and the rope serves as a PCD/Belay or the rope is used to haul the litter up as the litter attendants guide it over obstacles.

<u>Four types of Systems to be covered:</u>

- 1:1 (Georgia haul) w/ PCD (Munter hitch)
- Counter balance w/ PCD (single prusik)
- 3:1 (z-rig) w/PCD (single prusik)
- Litter attendants carrying the basket up with a Munter hitch PCD/Belay

Change of Direction pulleys

Discuss the need for directionals to increase the efficiency of systems. This can allow a team to build systems in areas that provide larger "throws" and more area to work.

Litter Attending

In low-angle operations it is preferred to always have several (4-6) litter attendants with the basket. Litter attendants should not attach themselves to the litter.

Responsibility of Litter Attendants

- Provide patient care
- Negotiate obstacles
- Protect the patient from falling debris
- Carry the basket if a haul system is not used

Types of Litters

The Ferno is the best choice for these types of operations. The plastic shell slides well over obstacles. A Stokes would be a poor choice; it catches on everything!!!

Evolutions

Several evolutions should be done allowing the students to build and operate systems in the low-angle environment. Evolutions should provide an opportunity to use all of the systems listed above.

REGIONAL STRIKE TEAMS EQUIPPING AND TRAINING
R.E.S.E.T.

General Rescuer Course
(Core Requirements)

Class Title:
High-Angle Field Work

NFPA 1006 JPR's:
5.5.4, 5.5.6, 5.5.8, 5.5.10, 5.5.11, 5.5.12

Time:
8 Hours

Scheduling Suggestions:
After Raising and Lowering Systems and Introduction to Vertical Hauls and Lowers

Materials/Equipment needed:
Equipment necessary for students to do High-Angle Evacuations

Instructor requirements:
1:5 Instructor to Student Ratio

Objectives:
At the end of this field day the learner should be able to:

- Demonstrate rigging edge transitions with "high help"
- Demonstrate rigging edge transitions with a low edge
- Demonstrate a lower and raise using a vertical litter with tag lines
- Demonstrate a lower and raise using a vertical litter with low and high point attachments
- Demonstrate a lower and raise using a horizontal litter
- Build and operate a Two Tensioned Rope System and a Single Tensioned Main and Un-tensioned Belay system.
- Demonstrate edge tending, with edge tender tied in short

Field Work Goals

The focus of this field work is to give the students more hands on time with vertical systems. A site should be selected to provide several different types of vertical problems. Instructors should be more hands off allowing the students to start selecting rigging methods on their own.

Edge Tending

At times it may be required for rescuers to travel to an edge that would expose them to a fall hazard. Means should be employed to safeguard rescuers from this hazard. The method to be used at the General Rescuer level is to use a travel restriction system. The method used will be referred to as being **Tied in Short**. The rescuer should **NOT** go over an edge and use this system to support their weight. It is only intended to prevent the rescuer from falling in the event of a slip.

1. The rescuer will plum the edge for desired length on the edge line that is tied off life safety to a suitable anchor
2. The Rescuer will then tie a figure 8 into the edge side of the rope; the rescuer will then attach the figure 8 directly to his or her harness.
3. Next the rescuer will attach a prussic loop onto the edge line, and then attach the loop end of the prussic to the same carabineer used to attach the figure 8 knot to the harness. The rescuer is now tied in short. He or she may move up and down the edge line safely.

Litter work

Opportunity should be provided to gain experience with various types of litter orientations. A site should be provided to allow "high help" to be used to ease the edge transition. Other scenarios should be done with low edge transitions. The litter should be rigged in several different ways:

- Vertical with tag lines
- Vertical with low/high-point attachments
- Horizontal with tag lines

Instructors should provide a full day of field work building on the concepts of two tensioned rope systems and single tensioned main and un-tensioned belay systems. These concepts are covered in the raising and lowering systems lesson. The system to be used for all evolutions is the two Munter hitches (for lowering device and PCD) with a block and tackle as the haul system.