



MOHAVE COUNTY SHERIFF'S OFFICE



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MOHAVE COUNTY SHERIFF'S OFFICE SEARCH AND RESCUE STANDARD OPERATING PROCEDURE FOR TECHNICAL ROPE RESCUES

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SCOPE AND PURPOSE

This MCSO SAR procedure establishes a standard structure and guideline for all search and rescue personnel operating at incidents involving life-safety technical rope rescue operations. The procedure outlines the responsibilities for searchers, ground support personnel, and technical rope technician (TRT) personnel responding to such incidents. These guidelines must be used in the response to life-safety technical rope rescue operations, which utilize ropes and/or rope systems, or a rescue helicopter, to affect a rescue. Because these technical rope rescue operations present a significant danger to all personnel, the safe and effective management of these operations require special considerations. These procedures identify some of the critical issues which must be included in managing these incidents. All other MCSO SAR procedures must apply to these rescue operations, where applicable.

In order to have an efficient response system in place for emergency rescues, effective pre-planning needs to be accomplished in advance. This requires a strong commitment by personnel that will result in improved operational readiness.

Safety is always of paramount importance. If you see any action that is unsafe, it is your responsibility to speak up!

OPERATIONAL CONSIDERATIONS

A life-safety technical rope rescue is defined as any rescue attempt that requires rope and/or rope systems and related equipment to safely gain access to – and remove a person from hazardous geographic areas/locations with limited access. The two categories of rescues are:

- **Non-Technical** – rescues with angles of inclination less than 40 degrees. Most searchers will have access to equipment and training to affect this type of rescue.
- **Technical** – rescues with angles of inclination from 40 degrees to 90 degrees. These rescues typically involve ropes and/or systems and must be performed by rescuers trained at the level of Technical Rescue Technician (TRT).

Rope rescue techniques and equipment utilized in wilderness rescue operations should take into consideration the recommendations established by National and International standards, such as those found in the following:

- National Fire Protection Association (NFPA),
- The American National Standards Institute (ANSI)
- The American Society for Testing and Materials (ASTM)
- European Economic Community Law (CEN)
- Cordage Institute
- Deutsches Institut für Normung (DIN) The German Institute for Standardization
- The International Organization for Standardization (ISO).

Because of the extensive material with each safety standard, this SOP will not be going into any detail. However, a good reference is the 2014 National Park Service Technical Rescue Handbook, Chapter 5 Standards and Industry Ratings and Appendix 5 of the book.

Due to the inherent dangers associated with these operations, the Mohave County Sheriff's Office Search and Rescue must develop and maintain a risk management profile to be applied to all life-safety technical rope rescue operations and continuously reassessed throughout the incident. A phased approach to technical rope rescue operations should be utilized to safely and effectively mitigate these high-risk / low-frequency events.

One format used to organize these phases into a successful rescue is referred to as "L.A.S.T.", which stands for Locate, Access, Stabilize and Transport. The specific method for accomplishing any of these steps will differ with each rescue and should be selected based on experience and the multitude of factors unique to the current rescue scene.

Technical rescue involves the "Access" phase, however planning and decision-making should simultaneously occur for subsequent "Stabilize" and "Transport" phases. Actions may include delivering appropriate EMS care for the patient in technical terrain as well as staging an ambulance or helicopter EMS aircraft for efficient transport.

Additional technical information is available in the 2014 Version of the Department of the Interior National Park Services Emergency Services Technical Rescue Handbook.

TECHNICAL ROPE RESCUES

Because of the broad range of variables that exist in life-safety technical rope rescue operations, there is no hard and fast rule for conducting one.

Safety

EVERYONE has a voice when it comes to safety. Rescuer safety is paramount in any rescue situation. Prior to conducting any technical rescue operations, a Safety Officer will be clearly identified and to ensure the rescue area is safe by securing the area, removing all non-essential personnel to the Cold Zone, and identifying any hazards in the rescue operating area. The Safety Officer will establish the

Warm and Hot Zones in the rescue operations area. The Safety Officer will ensure all personnel operating in the Warm and Hot zones are accounted for and wearing the appropriate PPE.

Pre-Rescue Operations

The rescue team will make assignments then assemble all necessary personnel, rescue equipment, and patient packaging equipment that will be required for the rescue operation.

The rescue team will develop a rescue plan and a back-up plan. The back-up plan must be in place prior to initiating rescue operations. Ensure the rescue plan and back-up plan, which include emergency procedures, are communicated to all personnel operating on the incident.

Order of Rescue

Because of the inherent risks involved in high-angle rescue, the method of rescue offering the least risk to the rescuer will be used. The following methods are listed in increasing order of risk. Factors influencing the selection include patient condition, rigging time, available manpower and/or equipment, and terrain conditions.

1. Talk the person(s) to be rescued into self-rescue.
2. Walk or climb with a belay line.
3. Rappel or lower with a belay line.
4. Pick-off with an independent belay line.
5. Raise person(s) to be rescued with a belay line.
6. Raise person(s) to be rescued and rescuer with a belay line.
7. Proceed with a stokes litter basket or SKED evacuation.

The order of rescue from low risk to high risk would be: Talk the person to be rescued into self-rescue. If the person to be rescued is not exposed to a life-threatening situation, it may be possible to talk the him/her into self-extrication. If the person to be rescued is exposed to a life-threatening situation, it may be best to advise the him/her to stay in place until a rope rescue system can be set up.

For terrain less than 40 degrees inclination, (non-technical), if the person to be rescued is ambulatory, he/she can walk down with the assistance of rescuers. If the person to be rescued is injured or unable to assist in their own rescue, he/she should be packaged properly in a stokes basket and carried to safety.

The stokes extrication should be conducted with a minimum of 4 litter bearers. Bearers should face the direction of travel during the extrication. If appropriate, a belay line (tag line) should be attached to the litter for assistance through unstable areas.

For terrain of greater than 40 degrees inclination, if the person to be rescued is ambulatory, he/she may be assisted down by rescuers with the use of a belay line (tag line). If appropriate, rescuers should set up an anchor system for the belay. A body belay may also be used by rescuers, if appropriate.

If the person to be rescued is not ambulatory, rescuers must build an anchor system and prepare for a steep angle evacuation. The patient must be packaged properly in a litter and prepared for the extrication.

For evacuations greater than 40 degrees, the TRT must conduct the extrication. Extrications greater than 40 degrees are considered high-angle operations. The TRT Team in consultation with the MCSO SAR Coordinators should decide the most appropriate method to extricate the person to be rescued. This may include putting the person to be rescued in a harness and raising or lowering them, or packaging them in a litter for the raising and/or lowering.

In most situations, systems will be built to the highest level of safety factor available. While up to the rescue team, the system safety factor of 10:1 is preferred. A separate anchor should be used for each line. Proper care must be taken to assure that the person to be rescued will not come out of the harness or litter used to extricate him/her. Whichever method of extrication is used, the TRT Team Leader must ensure the overall safety of the raising/lowering system and must designate the tasks of individual rescuers during the operation.

Upon the termination of the rescue operation, the Safety Officer must ensure personnel accountability.

SAFETY CONSIDERATIONS

The TRT managing the system is responsible to ensure the safety of the technical rope rescue. No member must enter Warm or Hot Zone until instructed to do so with an assigned task.

Safety should be prioritized by MCSO SAR members in the following order:

1. Personal safety
2. Team safety
3. Bystander safety
4. Person to be rescued safety

Situational Awareness – Most climbing and rescue related accidents are not a direct result of equipment failure, but instead have “human error” as a primary causal factor. Therefore, we should always engineer for and pre-plan for the weakness of the human factor on rescue operations.

Hazard Assessment (daytime/nighttime) – It is imperative to be aware of and to take into consideration of the hazards that are or may become associated with the rescue operation. What might not be a hazard during the daylight operations, may suddenly become a complicated hazard during nighttime operations. Consider the affects of inclement weather on the hazard profile, the person(s) to be rescued, and the rescuers. A constant reevaluation of the rescue scene is critical to prevent unnecessary risks.

Hazard Control – Hazards need to be controlled to prevent unnecessary risk to the rescue team, bystanders and the person being rescued. Every attempt must be made to control any hazards in the rescue scene.

Decision Point (Go or No Go) – Upon the recognition of a hazard in the rescue scene that cannot be controlled, a determination will then be made by the Incident Commander if the rescue operations will continue or whether the rescue becomes a “no-go” until the hazard can be controlled.

Evaluate (Human factors and situation, changing?) – Evaluation and reevaluation of the situation is critical, as environmental, mechanical and human factors over time can change the situation – possibly having a negative effect that could poorly affect the outcome of the rescue operation.

MEDICAL CONSIDERATIONS

In rescue operations that involve an injured person, the most advanced medically-trained SAR personnel should respond on scene first and provide medical aid based on the rescue situation to their level of training. All SAR members must take proper precautions to prevent further injury.

HELICOPTER OPERATIONS

Helicopter operations are considered high risk and the use must be decided upon by the MCSO SAR Coordinators and determined by the availability of a helicopter. Helicopter operations require an additional set of training and equipment. Those that are selected to be part of the helicopter short-haul team must be a TRT-trained member and strictly adhere to the Department of Public Safety (DPS) SOPs. Currency and proficiency guidelines are determined and maintained by DPS.

Factors to consider in the use of a rescue helicopter include:

- Condition of the person to be rescued
- Difficult access
- Difficult terrain
- Time of day
- Environmental effects on rescuers

TRT personal should be trained to establish a landing zone in an appropriate location.

TRAINING STANDARDS

AT NO TIME may any SAR member perform a technical rope rescue beyond their level of training. Members must have corresponding documentation of their level of training and continued proficiency in their files maintained at the Agency. See Appendix A for approved instructors.

All SAR members must be trained at the ***Awareness Level***. Upon completion of training, the member must have general familiarization and knowledge of the proper handling of the ropes and equipment used by the Agency in life-safety technical rope rescues.

Ground Support members must demonstrate proficient knowledge of the minimum Ground Support skill-sets and meet the minimum proficiency training standards annually to maintain certification as a Ground Support member as determined by the Rope Committee.

Technical Rope Technicians must demonstrate proficient knowledge of the minimum TRT skill-sets and meet the minimum proficiency training standards annually to maintain certification as a TRT member as determined by the Rope Committee.

APPROVED SYSTEMS FOR LIFE-SAFETY TECHNICAL ROPE RESCUES

The type of life-safety technical rope rescue systems used are largely based on situational circumstances. Rescue systems should be performed using two life-safety lines. The following systems are approved:

1. Mirrored systems using MPDs
2. Lowering system using a brake rack, MPD, or other device approved by the Agency in conjunction with a belay
3. Raising system using a mechanical advantage with high efficiency pullies, MPD, or other approved device by the Agency in conjunction with a belay
4. Rappelling to the location and either lowering or raising from there in conjunction with a belay
5. Highline rescues
6. Skate-block rescues

APPROVED EQUIPMENT FOR LIFE-SAFETY TECHNICAL ROPE RESCUES

Unit Equipment – All rescue equipment should be standardized between the Units and determined by the Rope Committee. Equipment should be packed in a similar fashion between Units.

All Unit equipment shall be maintained by the Units. All equipment, ropes and webbing used either in Systems or individually by Rescuers must be cleaned, maintained and/or replaced according to the manufacturer's recommendation. A log book must be maintained for all system equipment and made available for review upon request by the MCSO Coordinators.

Rescuers – All rescuers must use equipment, ropes and webbing with a minimum equivalent NFPA designation of "Technical Use" rating, or T-rated/single use. This equipment can be used to tie the rescuer into the system.

Equipment may be used only by members once trained and demonstrated proficiency on its specific use. Once a Rescuer *shows proficiency* with the new equipment, it must be approved by the Rope Committee (this can be accomplished by email) and then the equipment will be added to the **Rope Addendum**. Use of any equipment not identified below **MUST** be approved by the Rope Committee, prior to its use in a technical rope rescue. All equipment must be used according to manufacturer guidance and made by a reputable / well established manufacturer.

DEFINITIONS

Agency – The Mohave County Sheriff's Office, agency having jurisdiction (AHJ).

Anchor Straps – Must make a G-Rated (36 kN) anchor and used in a basket configuration, with a rating over 10,500 Lbs MBS, made by a reputable / well established manufacturer, and made in US.

Awareness – General familiarization and knowledge of proper handling of ropes and equipment used in technical rope rescues. These members may participate as a haul team member, pack gear and

equipment to a rescue location, and/or retrieve equipment required by advanced trained members during system construction. Members that have been training in low-angle litter handling may assist in low-angle operations under direction of a TRT.

AZV (AriZona Vortex) – This is a portable artificial high-directional that can be used as a tri-pod, bi-pod and mono-pod.

AZTEK (AriZona Technician's Edge Kit) – This is a versatile tool used in rope rescues that can assist with rigging operations.

Carabiners – Metal connectors with loaded gates, which are used to attach components in rigging. There are many different styles and types of carabiners. Know how to use what you buy. The Agency prefers the use of auto-locking carabiners.

Cold Zone – This area includes the Incident Command, the rescue staging area and may also include untrained personnel, law enforcement, medical personnel, fire personnel, bystanders, and family members. All SAR personnel must remain in the Cold Zone until they are assigned a task.

Croll L – One of several ascending devices.

Bridals – These are used with Stokes litter to manage raising and lower of a patient. Preferred use with steel autolocking carabineers.

Descenders – Descenders or descent control devices for rappelling, there are several devices already approved such as the Rescue 8, Scarab, Petzl ID, 3D, Clutch and brake rack (rappel rack).

Edge – All personnel within 6-feet of an edge where a drop of 6-feet or greater exists, must be tied to a safety line when working at that location.

Edge Attendant – The safety line must be on a separate anchor, when possible. A full-body rescue harness is preferred. Some of the duties include maintaining communication with the rescuer and managing the edge protection.

Edge kit – These kits are used to provide a tie-off for the edge person in the Warm and Hot Zones. They need to be adjusted for each use.

Equipment – A combination of ropes, webbing and hardware (such as pulleys, carabiners, the Arizona Vortex, etc.) make up the equipment used during life-safety technical rope rescues. It is imperative that the proper handling and care of this equipment is maintained throughout all rescues, training and storage.

Gloves – Genuine leather gloves should be carried by all TRT members and used during any friction event, such as rappelling or performing as belay (as the friction on the rope can cause other fabrics to heat up and burn or melt to the rope). Gloves made with other materials, such as nylon or synthetic materials may be used during rigging and hauling operations.

Ground Support – These members may perform at the edge as an edge-person to assist with communications between the rescuers and the system operators. These members may manage the equipment at the edge to ensure edge protection of the ropes and equipment, build and manage a basic system, perform safety checks, and participate in a low-angle rescue under the guidance of a TRT.

Harness- Is at least a class 2 harness meeting ATSM F1772 (or its European equivalent) or higher

Helmet – Must have a minimum ANSI-Z89.1 rating and must include a mounted headlamp.

High-Angle/Vertical Rescues – These technical rope rescues have an over-the-edge angle greater than 40 degrees. These rescues require a minimum of two TRT members to perform in combination with additional Ground Support members. One TRT must perform the actual rescue and the other TRT must manage the entire system and perform safety checks. Ground support members must assist as tasked by the TRT managing the system. High-angle rescues encompass both the Hot Zone and the Warm Zone. No untrained or untasked members may be in this area without approval by the TRT running the system. All personnel operating within high-angle rescues must be wearing full PPE. A rule of 12 must be used when determining the size of the Haul Team for High-Angle Rescues.

Highline Rescues – While not commonly used outside of swift water rescues, highline rescues must take extra caution into consideration when identifying anchors used and the stresses placed on anchors when establishing these rescue systems. The use of a highline must be determined by the TRTs at the rescue location. A rule of 18 must be used when determining the size of the Haul Team for Highline Rescues.

Hot Zone – This area is restricted to experienced Ground Support or Technical Rope Technicians only. It includes the entire area beyond the “line of death”, approximately 6 feet into the Warm Zone and the entire haul team footprint. Personnel operating in this area should be kept at a minimum, to reduce confusion and prevent unnecessary risks during the rescue operation. All personnel operating in this area must wear full PPE and be tied off to an appropriate anchor system. However, while situational dependent, the TRT managing the entire system must make the final determination whether the haul team requires being tied off to an anchor system.

Low-Angle Rescues – These technical rope rescues vary in slope from level areas up to 40 degrees. These rescues generally involve a lower risk and the use of ropes provide additional safety and a control of descent (such as litter operations over rough terrain). If a TRT is available, the TRT must manage the low-angle rescue operation. If a TRT is not available, an experienced Ground Support member may manage the low-angle rescue operation. The member managing the system should use a two-rope life-safety system, but depending on the slope and situation, may decide to use a one-rope life-safety system.

Lowering Systems – These systems are constructed to control the descent of a rescuer and can use an approved device or combination of devices, depending on the load of the system. Lowering-systems use a two-rope life-safety system (either a mainline with a belay line or with a mirrored tensioned system).

Mirrored Systems – These are two rope tensioned systems that divide the load between the two ropes, instead of the traditional main and belay systems.

MPDs (Multi-Purpose Device) – These can be used as part of a raising or lowering system and are rope size dependent. It is imperative that the right size MPD is used with the right size rope.

Patient Packaging – While there are many different methods for patient packaging, the preferred method is with the use of two 20-ft pieces of 1-inch tubular webbing or a recognized commercial brand such as the CMC Patient Tie-In System.

Pick Off Strap – Used by a rescuer to quickly connect to the subject and then adjust the commercially sewn strap to the desired length.

PPE (Personal Protection Equipment) – Required PPE in technical rope rescues include an ANSI-Z89.1-rated helmet, at least a class 2 harness meeting ATSM F1772 (or its European equivalent) or higher, leather or reinforced gloves (that offer abrasion and friction resistance), eye protection, a whistle (preferably attached to the harness) and occasionally ear protection (member must carry ear plugs that can be readily available when needed).

Raising Systems – These systems are constructed to raise a rescuer with the use of approved device(s), utilizing a configuration of a system of pulleys creating a mechanical advantage with a haul team. It is imperative that the TRT managing the system take into consideration the friction and load on the system. It is critical not to use more haulers on the haul team than is safe to use – so the Rule of 12 (for high-angle/vertical rescues) and the Rule of 18 (for highline rescues) must be used.

Rappel – When rappelling, employ a secondary conditional self-belay (such as a VT Prusik) as a backup.

Ropes – Ropes used in life-safety technical rope rescues must be constructed with static kernmantle rope, made by a reputable / well established manufacturer, and made in US.

Skate-Block Rescues – These rescues are designed to lower the load away from a specific object (such as a tower).

Technical Rope Technician – These members are responsible for technical rope rescue operations. TRT members may establish and perform over-the-edge rescues (steep-angle/vertical), and all Ground Support operations. TRTs should also be trained in establishing an appropriate landing zone location for rescue helicopters. The TRT is responsible for the safety, construction, management, and coordination of the technical rescue operation.

VT Prusiks – VTs in a basket configuration can be used as a personal / T Rated anchor.

Warm Zone – This area is used to stage rescue equipment and is restricted to Ground Support and Technical Rope Technicians only. Personnel operating in this area should be kept at a minimum, to reduce confusion and prevent unnecessary risks during the rescue operation. All personnel operating in this area must wear full PPE.

Webbing – 1-inch tubular webbing in varying lengths and colors with a minimum breaking strength of 4,500 pounds. Black webbing – 30ft; Green webbing – 20ft; Red webbing – 15ft; and Yellow webbing – 6ft. Eventually, all webbing will be phased out to 20ft length pieces.

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Date

Rope Addendum

