



## Continuing Education Course



# Rope-Assisted Search Procedures in Large-Area Structures

BY MIKE MASON

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# Rope-Assisted Search Procedures in Large-Area Structures

## Educational Objectives

On completion of this course, students will

1. Identify and understand the need for search in large-area structures while being able to recognize hazards when searching for distressed firefighters or civilians.
2. Assemble and construct the proper search rope bag system as well as position members and identify their roles and responsibilities in a rope-assisted search.
3. Identify and demonstrate the principles of anchor, point, and shoot as they pertain to object and human anchors while also identifying techniques in rope tethering.
4. Identify and perform the techniques and maneuvers of proficient rope line management, including locating distressed firefighters or civilians, incorporating their health assessment, and removing them along the main search rope line when exiting a large-area structure.
5. Recognize and discuss the importance of air management, accountability, command and control, and communications regarding firefighter Maydays and civilian rescues.

**BY MIKE MASON**

**M**ANY FIRE DEPARTMENTS THROUGHOUT the country could never imagine facing the task of rescuing a trapped, lost, or unconscious firefighter or a civilian in a large, complex structure. Factories, assembly halls, malls, mega-mansions, and department stores are just a few of the types of structures that necessitate that rescuers be soundly trained in search techniques.

Searching a large area that may be involved in fire or that has near-zero visibility when there is an urgency to save lives is a huge undertaking. The skills needed for these situations must be safely coordinated to be effective. When conducting large-area search programs throughout the country, we devote some of the most solid and up-to-date training to searching large areas while incorporating simple, but concrete, techniques that use rope-assisted search procedures to turn a huge task into a successful and safe accomplishment.

Using rope to search large areas is not new to the fire service. Unfortunately, sometimes ideas that are thought to be improvements

(1) The greater wall of large-area structures spans fewer exits.  
(Photos by author.)



in equipment and techniques sometimes turn out to be less than ideal. The focus here is to assist you and your department in establishing simple, accountable, safe procedures for rope-assisted searches in large and many times confusing areas.

### SEARCHING WITH A ROPE: PRINCIPLES

Following are some principles and philosophies that apply to searching with a rope in many of these overwhelming structures.

- Keep it simple.
- Realize the dangers.
- Ensure accountability.
- Realize the limitations.
- Know air management.
- Have the proper staffing and backups.
- Ensure that it is necessary to search with a rope before committing to it.
- Have an exit strategy.

We need to realize up front that the air supply on our backs is no match for the conditions we encounter when searching in large structures. We could encounter near-zero visibility and fire involvement in any portion of these structures while searching for a comrade or a civilian (photo 1).

When searching these structures using rope systems, you must have

(2) A modern search rope bag.



egress point; in some cases, egress will have to be rapid.

## SEARCH ROPE BAG DESIGNS

In earlier times, rope bags designated for search were usually large duffle bags containing utility rope that was not used solely for technical rescue. In part, this still holds true in that members drag search

a solid action plan that incorporates proper sectoring and accountability of all team members. The large-area search rope system must be appropriate for the type of search. The tools and equipment used must enhance the search's effectiveness and ensure the safety of the personnel. The members conducting the search using a rope should have the following:

- A search rope of manageable length in a manageable rope bag.
- A thermal imaging camera (TIC).
- Forcible entry tools/irons.
- A rapid intervention team (RIT) breathing system bag.
- Portable radios.
- Personal webbing and hand lights.
- A full personal SCBA.

Team members ready to enter a large area to search without these basic elements are jeopardizing their safety, the safety of the entire team, and the safety of the victim. Whether searching for a distressed firefighter or a civilian, the concepts of rope-assisted searches are essentially the same. A RIT searching for a lost or trapped firefighter in a large area or a team searching for a civilian should not exceed four members. Teams can be made up of two or three members, depending on the techniques and maneuvers used in the search. One firefighter alone should never conduct a large-area search on a rope in a structure.

Ensure that there is a rescuer *ready* as a backup for each rescuer who enters the structure to search. Many times, the members' searching priority is locating the victim, not necessarily also removing the victim from the structure, which will be the job of the backup teams, especially in the case of a downed firefighter.

Accountability for personnel (and their respective positions and responsibilities) on the search rope line is paramount. Only members assigned to a position on the rope line should be in that position. Everyone on the line should know his position on the line, and all members should make sure they are on the same side of the line when entering the structure searching, especially at the beginning of the search. The positions may change during some types of tether searches and when the team may be involved with rescue after locating the victim. Positions may also change when a rescue team enters the structure to join with the original search team that located the victim to assist in the rescue. *Note:* An accountability officer should be present at the teams' entry point at a rope-assisted search operation in large-area structures if a Mayday has been called for a lost or trapped firefighter or if a civilian needs rescuing. The entry point is not only the way in, but it will also be the

rope across floors, lay or step on it, and apply makeshift anchors to it. After the rope takes this abuse, you should never use it for life rescue or technical rescue.

The earlier rope bags were cumbersome; they often held up to 300 feet of rope. This should never be the case today.

In addition, some manufacturers today are producing many styles and types of search rope bags that incorporate various types of knot systems along with directional rings, colored tape, and even illuminated or lighted rope. My experience with search training programs during the past nine years has shown that the simpler and more manageable a search rope bag is, the better it is for firefighter safety.

Following are some bag features and equipment that have worked well for my department. Regardless of which system you purchase or assemble, the vital factor is that you train with it.

The items listed below are the basic essentials of search rope bag designs and functions. Adding to the complexity can add to confusion, air management difficulties, and entanglement situations (photo 2).

- No duffle bag or beach bag styles.
- Usually rectangular in shape and has a self-closing flap. It generally has small pockets for holding a piece of looped webbing with an attached carabiner and wire cutters.
- An adjustable shoulder strap with a quick-release buckle on each side of the strap.
- It will accommodate a rope size of eight to 10 mm and a length of 200 feet (the maximum); 150 feet is preferable.
- The rope should have a simple knot system (one knot at 50 feet, two knots at 100 feet, and the bag at 150 feet).
- Attach a large carabiner to the rope to establish an outside anchor; also attach a tag that designates the fire company using it.
- Two additional carabiners for other uses, such as establishing anchors, firefighter and civilian attachments, and applying tether setups.

## SEARCH ROPE MANAGEMENT: PRINCIPLES

The three basic behaviors search team members use when searching with a rope are the following:

- **Anchor.** Establish the first anchor in an area outside of the immediately dangerous to life and health

# ● ROPE-ASSISTED SEARCH



(3) Outside anchors need to be solid.



(4) The human anchor position with bottle wrap.

## KNOT SYSTEMS AND TETHERS

Some rope systems designated for large-area search are so complex that firefighters would not be able to use them efficiently and safely if they didn't train on them beforehand. Some have a knot every 20 feet, some have two different styles of knots every 20 feet, still others start with a knot at 20 feet and then add one every 20 feet. Can you imagine how many

(IDLH) environment. Establish all additional anchors when the search team must change direction in the interior of the structure.

- **Point.** The team leader and the team members decide on an intended direction of travel using audible sounds or visual indicators after establishing an anchor.
- **Shoot.** The team moves forward and deploys rope from the rope bag into the area of interest.

Regarding the “anchor, point, and shoot” principles, all rope systems and functions rely on this process. Any time a search rope team changes direction, the principles of anchor, point, and shoot are repeated. Team members establish anchor points in the search line to guarantee the stability of the search line and the safety of the searching firefighters.

Following are the types of anchors and their level of reliability.

- **Outside anchor.** The first anchor is set to a stationary object. You should not be able to move or pull it off regardless of how many team members are on the line and the activities they employ.
- **Interior wall anchor.** It is set by breaching a wall with a tool while using that tool and the main line rope wrapped around studs. It may be very unreliable, and it takes time to establish in zero-visibility environments.
- **Fixed object anchor.** It is set by wrapping or knotting the search rope around an object of significant size or a column. Its reliability depends on the object and the amount of time it takes to secure the rope line in near-zero visibility.
- **Human anchor.** A team member holds the search rope line, guaranteeing its security. It takes a little time to establish and increases the speed and safety of the search. It is the most reliable of the anchors (photos 3, 4).

knots you would have by the time you got to the end of a 200-foot rope bag?

The primary point of the knots is to tell you how far you have gone into the structure. The systems are getting out of control. The realizations about the knots put into the main search line is that firefighters traveling on the line more than 60 percent of the time missed them with a gloved hand. If they did feel one, especially in a multiple-knot system and they wanted to determine how far they had gone into the structure, they would end up trying to count them with a gloved hand, taking valuable time away from the search and their air supply.

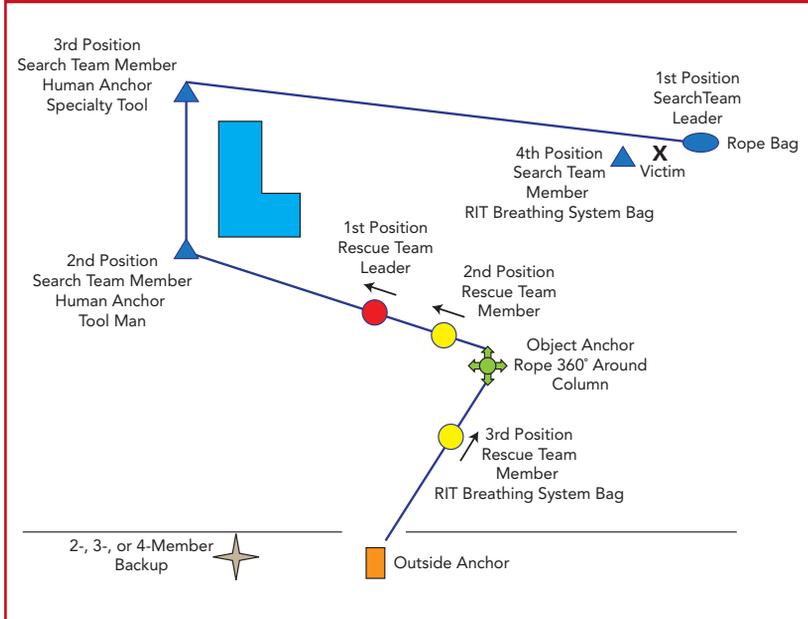
Some systems use the knots to search off while measuring the knot against the tether systems—meaning that if you arrived at a knot and you wanted to search with a tether that was also 20 feet long, you would end up at the next knot. Some departments were using systems requiring tethers 40 to 50 feet long. This is an entanglement nightmare waiting to happen.

First, ensure the safety and accountability of searching team members. Next, you must be able to tether search whenever and wherever you need to off the main search line while using tethers of manageable lengths. Tethers



(5) Overhand knot on a bight in the main line with tether. (6) Free Gate tether unattended. (7) Double extended tether. (8) Double extended tether, carabiner to carabiner.

**Figure 1. Search Team and Rescue Team Rescue Entry Diagram**



distressed firefighters or civilians.

A safe and efficient rope-assisted search team should have three or four members who will enter a possible IDLH environment. If only two members are available to enter using a search rope, they should use the “Rope-Assisted Minimum Manning” (RAMMS) method, which will be described later.

### Positions and Roles of a Three- to Four-Member Team

The positions and roles of a three- to four-member rope search team include the following:

- First Position/Team Leader: carries the rope bag/TIC/portable communications.
- Second Position/Tool Man: carries the halligan bar or ax/portable radio.
- Third Position/Specialty Tool Man: carries rabbit tool/halligan or ax/portable radio.
- Fourth Position/RIT Breathing System Bag Man: carries RIT breathing system bag/portable radio.

If only three members are entering, the third position would become the RIT breathing system bag member. When the team is ready for entry, the team leader/of-

should be made from webbing put into loops that are water knotted and should not exceed 20 feet, and they should have a carabiner attached to them. It is not recommended that you use external pouches of small-diameter rope holding 30 to 50 feet because of the hazards of collection and entanglement. Also, when using a tether to search off of a main search line, ensure that you search only 180° on one side of the line from which you are searching; never pass over the main search line in an attempt to search in a 360° fashion. This would create additional entanglement hazards and possibly entangle your team members (photos 5-8).

### SEARCH TEAM DEPLOYMENTS

Deployments are based on the need and confirmed information of whether a Mayday or a search for a civilian is involved. Before entering the structure, ensure that the entire team has a full air supply. Next, make sure that a RIT breathing system bag is prepared and ready, that enough backup members are present to form another team, and that a control member is at the entryway. Be sure that all parties have optimal and functional radio communications. As already noted, in any large-area search, the initial search team should verify that it is being backed up by a rescue team that will help the search team to rescue/remove



(9) First position team leader with rope bag and thermal imaging camera. (10) Second position search member on rope line, the tool man. (11) Third position search member on rope line, specialty man. (12) Fourth position search member RIT breathing system bag man.

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fighter conducts a thermal scan of the entryway and decides on the point and direction of travel. The team leader should provide a quick look of the scan to the second-position member as well, for orientation. This confirms the decision on the direction of travel. Many times, the distressed firefighter can be seen immediately; other times, an alerting PASS device or radio communication will determine the direction of travel. In the case of civilians, the team should obtain solid information on the area of the victim's location prior to entry (photos 9-12).



(13) Another human anchor position—the bottle wrap.

- Diligently control the rope bag and the amount of rope being played out at a given time. Never allow members or entanglements to unknowingly rob the rope inside the bag.
- When the team must change direction, establish object or human anchors that are secured and ready before moving forward.

When entering, team members should leave space between one another and not follow too closely. It's a good idea to travel in a partnered fashion, leaving a gap between the first pair in and the second pair in. The team's entry may be in light smoke at first because the fire involves another area of the structure. The light smoke should not lure team members into complacency or a false sense of security. In some cases, as the members move farther into the structure, conditions will worsen. Team members should adhere to their training and the techniques, relying on the principles of rope deployment involving anchor, point, and shoot regarding changes in direction. If members need to change direction, and good visibility is present, they should apply a change of direction anchor to a large object, column, or wall. This can be done quickly in good visibility, and it ensures that the anchor will not give way. If visibility is poor and it is not known whether object anchors are present, one of the team members should become a human anchor. The move should be quick but methodical.

If any member on the line experiences problems with his air supply, it is best to send the member out of the structure, preferably with another member. Another option is to have an outside backup member follow the search line in to the member with the air problem and assist him in exiting the structure. This provides for solid accountability while the remaining members continue the search.

This may limit the search to a degree, but locating a distressed firefighter or civilian is still the objective, even though these methods may involve an increased risk. One of the greatest successes of rope search is locating the victim. When this occurs, the standby team can come to assist in the rescue simply by following the secured search rope to the initial search team and the located victim.

Some of the important responsibilities of the team leader in managing the search rope are the following:

- Continuously hold the rope above the ground and keep it as taut as possible.

### Human Anchors

The concept of human anchors is relatively new to rope-assisted search. The human anchor provides the rope search with amazing speed and flexibility in large and complex areas where fixed-object anchors are unavailable or not stable. Using an object anchor with a human anchor helps prevent search rope from wrapping tightly into and around corners, which can impede rescuers entering to assist in the rescue by inadvertently causing them to run into walls. It can also impede the initial search team and rescuers coming out with a victim, who might jam into a wall while struggling with the search line and victim trying to get around the wall or corner. Establishing a human anchor or even an object anchor that can keep the searchers from wrapping tightly around corners will improve speed and safety. Using a human anchor also provides an audible position for everyone moving up and down the search line and increases the surveillance of dangers that may be related to changing conditions within the search area. It also guarantees the tension of the search line and enables the member functioning as the anchor to feel activity on his left or his right of the running search line he is holding.

The two main positions for establishing a human anchor are the front bight on a rope position and the rear bottle wrap position. Both positions require that the searching member take a tripod-type position on his knees, distributing his weight evenly and staying firm while pulling on each side of the rope, creating tension to keep the line taut and off the floor. When the team leader assigns a human anchor, the human anchor should be set next to the team leader in the search line and not be established by a member farther back down the line. Set anchors precisely where they are intended. Once an anchor (human or object) is set, the members move around the anchor, always moving the RIT breathing system bag along with them (photo 13).

### THE SEARCH TEAM AND TETHERING

There are several methods of searching off the main search rope. In reality, we are never searching off the



(14) Locating the victim. The officer is controlling the main line. (15) The team leader off to the side controlling rope. (16) The rescue or search team exiting with the victim.

main line: We are tethered or connected to it in some fashion. The keys to searching while using tethering are, again, simplicity and purposeful techniques in application. Many fire departments and their members get into trouble with tethering by using long tethers, which create management and entanglement problems, neither of which is welcome in a possibly compromising IDLH environment.

When assembling tethers, never create one with a small-diameter rope that exceeds 15 feet. In fact, we prefer that rope tethers not be used at all because rope cannot be used as easily as webbing to help in rescue efforts, and rope does not store well in pouches or pockets during deployment. Webbing is the tool of choice. The webbing should have a carabiner attached to it that does not exceed a 20-foot loop that is water knotted. Its applications in search are numerous, as are its applications for firefighter rescue and survival.

## Tethering off a Main Search Line with Webbing

The five best methods of tethering off a main search line with webbing follow.

- **Member-attended tether.** One member holds the webbing tether by its loop and carabiner, grasping the main line while the other member extends out, holding the other end of the loop and performing a sweeping search of an area about 180° to his side of the line.
- **Overhand knot tether.** An overhand knot is placed into the main search line at any point of interest (ensure that it is not a slip knot). One member places his webbing into the loop of the overhand knot with his carabiner, or it can be held by another member attending to it while the member extends out to search with the length of his webbing.
- **Free gate tether.** A webbing tether with its carabiner is hooked onto the main line and is unattended while the searching member extends out, searching up and down the main line in between two team members.
- **Double extended tether.** Two individual looped

webbings are attached by their carabiners, or one looped webbing is attached by its carabiner to the main line with the other looped webbing attached to the loop of the first piece. This requires a member to attend to the extended tether where it meets the main line because of potential management and entanglement problems that could occur to the member searching from being out an extended distance longer than 20 feet.

- **Team leader fanning method.** Using the main line rope from the search rope bag, one member holds tight the rope point of the team leader as an anchor while the team leader plays out 10 to 20 feet of rope while holding it taut; he fans from right to left or left to right directly in front of the team members on line. Imagine a wide fog pattern coming from a nozzle.

The above-mentioned tether applications are simple and manageable in near-zero or zero visibility environments. Remember also that when members are tether searching off the main line that the team leader ensures that no rope is unknowingly being pulled from the rope bag and that the other members are responsible for holding the line extremely taut along with the team leader (photos 14-16).

## TEAMS LOCATING AND RESCUING

The search team, as previously noted, may not necessarily remove the downed firefighter or located civilian from the structure. That is the reason it is important for there to be an organized and communicated rescue plan for removing the victim and that backup members are ready to enter from the outside anchor and that the search team lay out a secure rope line. If the search team is able to follow a secured rope line to the victim and the search team, it can arrive within seconds or a couple of minutes, depending on the amount of rope line laid out and accounting for any changes in direction set into the line.

Once the victim is located, the team leader with the rope bag moves off to one side of the victim, limiting himself in his involvement with the assessment and

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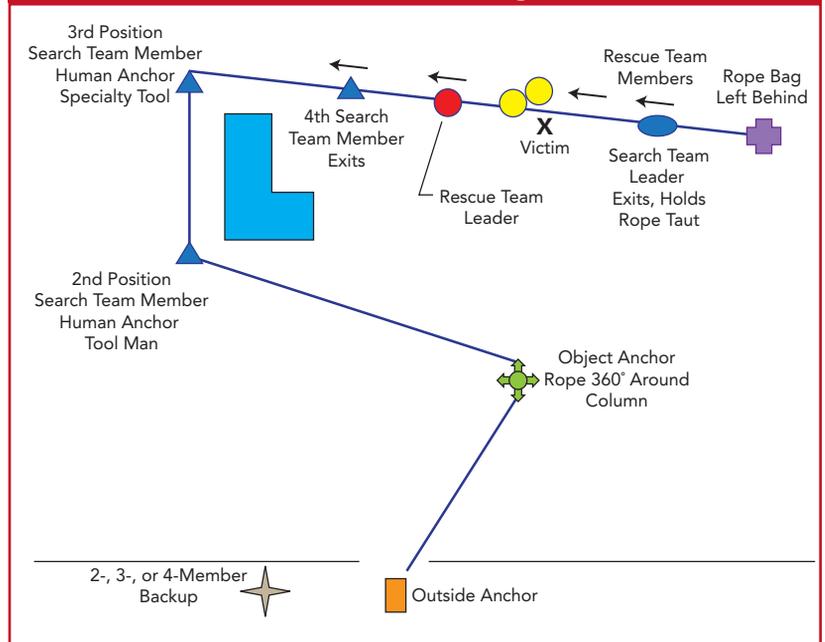
packaging of the civilian or distressed firefighter. This allows him to concentrate on holding the rope taut while also scanning the area with his TIC as his team members prepare the victim for removal. If by chance the team leader arrives at the victim by himself because of the use of human anchors applied during the search, he will perform a limited assessment while calling for assistance that will come from the backup team waiting outside the IDLH environment to come down the search line. The team leader needs to control the rope bag and the line at all times, ensuring that he has not entangled the bag around the victim. If he has one or more of his team members present, he will still call for the backup team while his members are preparing the victim for removal.

The backup rescue team can be made up of two, three, or four members. When called on, they will be able to move very quickly down the rope line the search team laid down. If the rescue team encounters an object anchor, the team will facilitate a change in direction, being careful not to disturb the line placed on an object anchor. If the rescue team coming in arrives at a human anchor who is a member of the search team, team members will go around that member acting as the human anchor and proceed on through the change of direction. A quick verbal communication from the rescue team leader and the member acting as the human anchor will take place regarding any important information while ensuring that the member acting as the human anchor has an adequate residual air supply. Most members assigned as human anchors usually have the most reserve air left because of their being stationary and conserving their air through proper breathing. Rescue teams moving quickly down the line should avoid colliding with the human anchor, which they can easily avoid because the human anchor can feel their presence coming down the line and can call out a warning that they are approaching a human anchor.

Once the rescue team arrives at the victim's location, the rescue team leader communicates directly with the search team leader as the members of the rescue team begin to work with whatever remaining members are left from the search team. This can be a very confusing time for all members at this location because they are all in close proximity to each other. They must call on their training and exercise discipline. The following communications need to take place to ensure that everyone will egress safely with the victim or distressed firefighter.

- The rescue team leader and search team leader communicate. The rescue team leader ascertains that the

Figure 2. Search Team and Rescue Team Rescue Exit Diagram



search team leader has an adequate air supply to continue controlling the rope line and the bag.

- The search team members remaining at the victim after packaging and positioning the victim for removal will allow the rescue team to perform the hands-on process of removal while the search team members place themselves on the rope line ahead of the rescue team removing the victim.
- The rescue team and its team leader will ensure that when ready for egress, the victim is on one side of the line along with the rescue team members. One member needs to be in contact with the rope line at all times, leading the way, while other members may be in contact with each other while maneuvering the victim.

The important thing to realize here is that the search team has less of an air supply than the rescue team that has just come in following the previously laid out rope line and its anchors. It is imperative that both rescue and search team leaders ensure everyone's air supply needs. A rescue team leader may have to replace the search team leader controlling the rope line and bag if necessary, allowing the search team leader to exit ahead of the rescue team because of low air. This mode of thinking should be applied to anyone whose air supply may be diminished; team leaders need to get those individuals ahead of others with better residuals of air. This can only be done through extreme cooperation and diligent accountability by all, especially the team leaders.

### EGRESS AND ROPE LINE CONTROL

Just as it is important for search and rescue team leaders and their members to control the rope line going in,

so is it important to control the rope line while going out with or without a victim or distressed firefighter. Rapid egress out of a large-area structure with a victim or a distressed firefighter along with all team members takes training and discipline. The team leader or officer is the first member in on a large-area search rope line whether it's the search team or the rescue team. The secret to accomplishing this is making sure the members are accounted for in accordance with their air supply and are controlling the rope line and the rope bag from which the rope is playing. When leaving with or without a victim, make sure that search team members with diminished air supplies are ahead of the rescue team members; this also diminishes their workload and involvement, thus conserving their air supply. The team leader controlling the rope bag will be the last out.

When members are exiting, the first thing the team leader needs to do is disconnect the bag from his person while he is still holding the line taut. Rope bags that have been deployed will never be collected. Doing so would only create entanglement problems that would endanger members and the rescue effort. Leave the bag behind, and lean back on the rope line, keeping it taut while you exit. Stay about 20 feet back from the members in front of you so you can monitor them and avoid coming up on them. They need room to work and a taut line to follow.

As you follow the team members out from a distance, you will come across anchors (object or human) the team set while going in. When you are moving forward on the rope line and meet an object anchor, expect a change of direction. When meeting a human anchor, stop for one moment to see if the member is ready to leave and that your air supply (team leader) is adequate for you to keep bringing up the rear. If it is not, you may assign the rear anchor to take the position of this member while you move quickly farther up the line for an exit. If you feel your air supply is adequate, send the human anchor member out on the rope line following up the line behind the rescue effort. In some cases, this may not occur, especially if the search team leader has traded places with the rescue team leader earlier when they were both meeting at the victim's location because of the search team leader's diminished air supply.

The majority of rope-assisted searches involving all members should be put into a subconscious time frame that matches the air supply of the rescue and search team members. This marker should be 12 to 14 minutes whether a victim or distressed firefighter is located or not; that's for both ingress and egress. If the search team does not locate the victim, leave the bag and follow the same procedures coming out regarding your members. Again, leave deployed search rope bags behind, no matter what.

There are also important issues regarding the status of the main rope line and its bag that should be communicated to other teams and sector officers when leaving the

structure. The following are status conditions pertaining to a deployed rope line from a search rope bag.

- **Totally unsecured.** No victim found; no anchors/change of directions applied.
- **Partially secured.** No victim found; some object anchors applied.
- **Applied unsecured.** Victim attached to rope; object anchors established.

*Note:* Rope lines or rope bags that have been attached to victims may have been applied without removing the victim because search teams were running low on air or conditions became untenable. Also, many times search teams don't find anything and leave an unsecured rope line and bag back in the large-area space. In this case, no other search or rescue team will ever use this same line unless it is definitively secured. Instead, a new line will be deployed when additional searches are needed nearby or at other areas of the structure.

## ROPE-ASSISTED MINIMUM MANNING SEARCH (RAMMS)

This procedure uses some of the same principles and procedures as a regular rope-assisted search, but the application is entirely different. It is adjusted to accommodate fewer searching members. It is designed as a quick investigative search when it has been confirmed that a downed firefighter or a civilian is in an area or a depth of 50 to 75 feet from an entranceway. In this type of rope-assisted search, one or two members would search while one member, preferably the team leader or officer, remains at the entryway with the rope bag. This search requires the following tools, equipment, and members:

- Rope bag.
- A 20-foot looped webbing with a carabiner attached for each member searching.
- TICs.
- Portable radios.
- Hand lights.

It also will require one to three members outside, whose main function will be to haul the rope line out when a victim or a distressed firefighter is attached to the line while the interior one or two members search and also help guide the victim along or assist by dragging the victim. It works as follows:

- The team leader secures the rope line to a solid outside anchor outside the IDLH environment while positioning himself just outside the entry area, holding and controlling the rope bag along with his TIC.
- One or two searching team members hook onto the rope line coming from the bag and the outside anchor with their webbing attached to the carabiner attached to the line. The excess webbing is wrapped back to the carabiner attached to the line around the firefighter's gloved hand.
- One or two searchers begin searching at the entryway just in front of the team leader controlling the

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(17) Two members on the rope line.

(18) Team members on their tethers in Rope Assisted Minimum Manning Search.

(19) Team members preparing for haul and removal of victim.



accomplished with voice communications on the outside and a combination of radio communications and voice to the rescuers on the inside, depending on their depth in the structure (photos 17-19).

This type of search and its rope-assisted techniques work very well for getting in large areas quickly. RAMMS does not allow for object anchors or human anchors and should

not be employed with this method of search. This search is one of the highest-speed searches for areas and depths of up to 80 feet while also allowing searchers to separate, span, and sweep continually, covering wide areas. Providing direct hookup of the victim or distressed firefighter to the main rope line decreases the dragging the interior searchers/rescuers must do, freeing them to spend more time guiding the rope.

rope line and bag. As they enter, they begin unraveling their webbing, sweeping and searching the immediate area until their webbing is fully extended with their carabiners attached to the rope line. They then begin to pull on their webbing, receiving more rope from the rope bag with the team leader's controlling its playing out as they proceed in searching and sweeping deeper into the area. If there are two searchers, they can spread apart or come together at will through their voice communications.



One important drawback of this method is that interior rescuers can overrun the main rope line and prevent the outside members and the outside team leader from controlling the main rope line. Interior rescuers must allow the hauling actions by the exterior members to function and relieve themselves of the victim's weight and help conserve their air supply. The interior rescuers are responsible for guiding the victim, as well as lifting the victim around and over objects, while the hauling action by members on the exterior are pulling most of the weight to the exit point.

- The team leader controlling the rope will ensure good rope line management, member accountability, radio communications, and surveillance with a TIC.
- When the victim or distressed firefighter is located, the searching members will apply any of several methods through the use of his webbing and carabiner to attach the webbing and carabiner to the victim and to the bight (curve or loop) in the main rope line.



- Attaching the webbing and carabiner to the victim is different from attaching the harness to a downed firefighter. Several methods should be created through training.
- The victim or distressed firefighter is now ready to be hauled: Exterior members grab the main line rope coming from the rope bag from which the team leader was playing out the rope. The team leader can leave the stored rope in the rope bag on the ground and join the hauling members or depend on other members to remove the victim. It is preferable, when possible, to leave the team leader at the entryway communicating with the interior searchers and with the members hauling on the outside. This is usually

We have covered two of the most

beneficial rope-assisted search maneuvers for the fire service. There are many other theories, techniques, and maneuvers, but these two procedures, with the proper training, have been proven to work time and time again. In addition, they provide simplicity, which we look for in times of extreme duress such as when rescuing distressed firefighters and civilians in compromised large-area structures.

### TECHNOLOGIES AND SEARCH

We must further consider the technologies now available from the fire service industry and those to be introduced in the near future for rescuing civilians and, most importantly, distressed firefighters in large-area structures.



# Rope-Assisted Search Procedures in Large-Area Structures

### COURSE EXAMINATION INFORMATION

To receive credit and your certificate of completion for participation in this educational activity, you must complete the program post examination and receive a score of 70% or better. You have the following options for completion.

#### Option One: Online Completion

Use this page to review the questions and mark your answers. Return to [www.FireEngineeringUniversity.com](http://www.FireEngineeringUniversity.com) and sign in. If you have not previously purchased the program, select it from the "Online Courses" listing and complete the online purchase process. Once purchased, the program will be added to your **User History** page where a **Take Exam** link will be provided. Click on the "Take Exam" link, complete all the program questions, and submit your answers. An immediate grade report will be provided; on receiving a passing grade, your "Certificate of Completion" will be provided immediately for viewing and/or printing. Certificates may be viewed and/or printed anytime in the future by returning to the site and signing in.

#### Option Two: Traditional Completion

You may fax or mail your answers with payment to *PennWell* (see Traditional Completion Information on following page). All information requested must be provided to process the program for certification and credit. Be sure to complete ALL "Payment," "Personal Certification Information," "Answers," and "Evaluation" forms. Your exam will be graded within 72 hours of receipt. On successful completion of the posttest (70% or higher), a "Certificate of Completion" will be mailed to the address provided.

### COURSE EXAMINATION

- What are some of the basic principles and philosophies that should be incorporated into large-area search maneuvers and equipment?
  - Use ropes that are long enough and strong enough to penetrate deeply into large-area structures
  - Limit the number of firefighters involved in search because of the complexities regarding accountability
  - Provide simplicity, accountability, and proper staffing; be sure it is needed; and have an exit strategy
  - A and B
- What is the most prominent point regarding air management relating to large-area structures and interior searches?
  - Use SCBAs that can hold the greatest amount of air
  - The air supply provided cannot compete with the size and complexities of large-area search, which demands strict air management during these procedures
  - Each member should bring in an extra air cylinder when entering large-area structures for search
  - As long as an accountability officer is present at the entryway, search teams can proceed for as long as 15 to 20 minutes before exiting the structure as long as a rope is provided
- What are some of the proper tools and equipment that should be used during large-area searches?
  - Sledgehammer, ax, rabbit tool, and thermal imaging camera
  - Rope, ax, halligan bar, head lamp, and radio
  - RIT breathing system bag, rope pack, premade two-to-one rescue system, and radio.
  - Manageable rope bag, RIT breathing system bag, radio, and thermal imaging camera
- Rope-assisted search teams, whether searching for distressed firefighters or civilians, should have how many members minimum to maximum?
  - One to two always
  - Five to six for larger areas with no backup team required
  - Three to four with a backup team of the same number
  - The number depends on who and how many victims need to be found
- What are some positive features of search rope bag designs?
  - A rope line with a minimum length of 300 feet should be in a strong duffle bag
  - Rope bags should incorporate 250 feet of rope line; smaller pouches should carry 35 to 40 feet of rope for tethers
  - Rope bags should be of rectangular shape and carry between 150 to 200 feet of rope and employ a simple knot system that identifies the depth of a search as well as provides a large carabiner for anchoring
  - Rope bags should provide 200 feet of rope with two large carabiners along with several knots put into the rope for increased grip as well as identifying depth into a structure
- What are the three basic repeated behaviors and principles of action that can occur during search activities when using large-area search rope?
  - Anchoring, communicating, and searching
  - Pointing, indicating, and moving forward
  - Signaling directions, anchoring, and sweeping
  - Anchoring, pointing to the direction of travel, and shooting out on the main rope line with the process repeated at each change of direction
- What are the four basic anchor types used when searching large-area structures to manage the main rope line's stability and guarantee egress for team members searching?
  - Interior anchor, exterior anchor, pliable anchor, and FIT anchor
  - Outside anchor, interior wall anchor, fixed object anchor, and human anchor
  - Outside anchor, tie-off anchor, drywall anchor, and halligan anchor
  - Object anchor, halligan anchor, pliable anchor, and drywall anchor
- Which of the following statements are correct regarding knot systems and tethers that incorporate them?
  - Tethers should be as long as possible to allow team members to search greater distances off the main search rope line
  - Tethers should not exceed 20 feet, should be made from webbing that incorporates a water knot that creates a loop, and that has a carabiner applied to the loop
  - Knot systems employed in a rope should be minimal to identify crucial depths into a structure while tethers can be applied by team members anywhere on the main rope line to extend searching out to a 180° area on one side of the main line
  - B and C



# Rope-Assisted Search Procedures in Large-Area Structures

15. The five accepted methods of tethering to a main search rope line while extending searches 180° off the right or left of a laid rope line are
- Member Attended tether, Member Unattended tether, Hook and Go tether, Box Tether, and Overhand Knot tether
  - Overhand Knot tether, Assisted Member tether, Box tether, Shoelace tether, and Member Attended tether.
  - Member Attended tether, Overhand Knot tether, Free Gate tether, Double Extended tether, and Team Leader Fanning method
  - Team Leader Fanning method, Assisted member tether, Hook and Go tether, Box tether, and Shoelace tether
16. When the search team has located the victim, the team leader is responsible for doing the following:
- Call for help and control the rope bag while moving off to the side of the victim, ensuring that the rope is held taut while monitoring team members and surrounding conditions
  - Assess the firefighter and assist in packaging and removal of the victim, controlling the rope bag at all times
  - Move off to the side of the victim and continue searching for more victims in the area
  - Control the rope bag, keeping the rope flat on the ground away from team members, assessing and packaging the victim while watching for approaching fire
17. While a search team is searching for a victim, a backup team must be present for the search team as well as to assist when called to rescue the victim. What is an appropriate size of the backup team in relation to the search team in large-area searches?
- The backup team should generally mirror the number of members of the original search team to ensure the safety and successful egress of the victim and the searchers
  - One member on a backup team is sufficient to enter the structure along the main rope line to assist in the rescue
  - The backup teams should have at least four to five rescuers in case the search team needs full replacement during the search
  - The backup team should be used only if absolutely necessary when the search team is running low on air.
18. When a rescue team is used to assist the search team in removing the victim, what important communications and maneuvers should be employed for all members and the victim to ensure safe egress from the structure?
- The rescue team leader and search team leader should communicate the air supply situation for search team members, ensure that member are in their positions on the line, and that rescuers egress on the same side of the rope line
  - Rescue team leader and search team leader will assist in rescuing the victim, making sure to bring out the rope bag with them while ensuring that all members are present on the same side of the rope line.
  - Rescue team leader and the search team leader will communicate their air supply while positioning themselves ahead of the rescue to lead the way out on the main rope line
  - A and C
19. Search rope bags deployed by search teams and their team leaders are never collected when exiting a large-area structure whether a victim is located or not. These bags are disconnected from the team leader and left behind while the team leader still controls and manages the rope line for all members exiting the structure. What important information about the rope line and its rope bag should be reported to commanders and other backup team members who may be ready to continue additional searches?
- Whether the rope bag and the main line rope are totally secured, partially secured, or applied unsecured
  - That the rope bag and main line rope are partially secured, anchored secured, or tethered secured
  - That the rope bag and main line rope are double secured, incompletely secured, or half secured
  - None of the above
20. When can searches be conducted in large areas when using a Rope-Assisted Minimum Manning Search when trying to locate and rescue civilians or distressed firefighters?
- This application can be used only when structures are heavily involved in fire because it provides for limited entry and requires no personnel monitoring
  - This application cannot be used in areas such as entryways or with large, open floor plans
  - It is specifically designed as a quick investigation search when a downed firefighter or a civilian is confirmed to be in the entryway area that opens up into large areas and requires less staffing
  - Requires less staffing and accountability for known victims or distressed firefighters in open large areas while providing less of a need for rope line management

## Notes

## Rope-Assisted Search Procedures in Large-Area Structures

### PROGRAM COMPLETION INFORMATION

If you wish to purchase and complete this activity traditionally (mail or fax) rather than Online, you must provide the information requested below. Please be sure to select your answers carefully and complete the evaluation information. To receive credit, you must receive a score of 70% or better.

Complete online at: [www.FireEngineeringUniversity.com](http://www.FireEngineeringUniversity.com)

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Mail or fax completed answer sheet to  
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1421 S. Sheridan Road, Tulsa OK 74112  
Fax: (918) 831-9804

### PAYMENT & CREDIT INFORMATION

Examination Fee: \$25.00      Credit Hours: 4

Should you have additional questions, please contact Pete Prochilo (973) 251-5053 (Mon-Fri 9:00 am-5:00 pm EST).

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| 2. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D  | 12. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
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- |  |       |   |   |     |    |
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