

# ***SEARCH LINE SURVIVAL TRAINING***

***By: Timothy E. Sendelbach***

## **INTRODUCTION:**

The use of search lines (or lifelines) on the fireground is not by any means a new concept. Some departments have been training their firefighters to use various types of search lines for better than 20 years. Unfortunately, few to my knowledge have addressed the complexity of search line survival training. Search techniques, search patterns and deployment methods are all necessary, but user confidence and the ability to identify and navigate potential hazards during search line operations is of extreme importance for the safety and survival of our members.

As we look at search line operations, the complexity of the search techniques and search line deployment only begin to touch the surface of what is necessary to conduct a search line operation. Issues of incident management, fireground accountability/tracking (personnel accountability reports), communications (progress reporting, "emergency traffic" procedures), proper use of PASS alarms, confidence in SCBA operations (partial and full-escape procedures), hand tool usage for navigation and probing all become an intrigue part of search line survival training.



This program has been designed as a multi-faceted training program that incorporates some of the most common fireground hazards into a realistic training scenario beneficial to all ranks. This program will not only provide participants with the necessary survival skills for safe and effective search line operations, it will also enhance some of the most basic skills of effective fireground management.

## **PRESENTATION:**

In August of 2000, Anthony Avillo and Mike Nasta, wrote an article for Fire Engineering Magazine titled "*Lessons Learned From Mask Confidence Training.*" This article features a mask confidence course that requires the participants to overcome some of the most common hazards found on the fireground today, hazards such as; holes in floors, open floor joist assemblies, entanglements, restricted openings were all addressed. As I read this article, I decided to take advantage of the ideas and concepts presented, while at the same time add some additional aspects that would enlist the skills necessary for search line survival training. The following information is a brief overview of what was developed.

## **PURPOSE OF SEARCH LINE OPERATIONS**

The purpose of a search line operation is two-fold, first, search line operations are oftentimes deployed during large area operations including; supermarkets, warehouses, theaters, etc. and when a large area must be searched with a minimal number of on scene personnel. The use of search lines and/or tag lines allows a group of as few as six (6) members to cover a large area safely and effectively in a short period of time.

Secondly, search lines are deployed as a means of orientation for entering and exiting firefighters. Traditionally, firefighters are trained to orientate themselves by maintaining direct contact with walls; search lines provide a secondary means of orientation while providing firefighters additional flexibility and mobility in their search efforts.

The use of search lines during Safety Engine/RIT search operations is also becoming more common. Search lines are quickly deployed and provide a method of tracking the area searched while at the same time providing an immediate means of orientating members for rapid egress. In the case of Safety Engine/RIT search operations, search lines provide a more direct path of escape than the traditional wall orientation. This direct path also provides a quick point of directional reference for incoming rescue crews to expedite the rescue efforts.

## **TOOLS AND EQUIPMENT FOR SEARCH LINE OPERATIONS**

**Floodlight or Spotlight** – A large floodlight or spotlight should be placed just inside the entrance to serve as a point of reference for rapid egress incase of disorientation. Members conducting search line operations should be trained to go towards light if they should become lost or disoriented.

**Search Rope (Guideline)** - The Search Rope / Guideline should be a lightweight rope (7/16 – 3/8” diameter at least 200’ in length with distance and directional knotting provided every 20’) carried in a durable sling style rope bag. The Guideline should be provided with snap hooks (or similar) on each end to enable the Search Leader or Safety Engine/RIT Officer (Depending on the type of operation being deployed) to quickly secure the line to a solid/stationary object just outside the hazard zone prior to initiating the search.

Consideration should be given to carrying various marking devices (such as chalk, lumber crayons, door markers, etc.) and wedges in a pouch/bag attached to the guideline rope bag to mark search areas, enhance orientation of members branching off the guideline, and to secure doorways. Additional directional marking can be provided with small portable flashing strobes placed at each change in direction (attach the portable strobe to the tie off point).

**WARNING:** As with any search line operations, careful consideration must be given to potential of thermal insult to guidelines and tag lines. Hose lines or high temperature search lines should be deployed where conditions for high heat or direct flame impingement exist.

**Personal Tag Lines (Branch Lines)** - The tag lines should be a lightweight (9mm diameter, preferably 20-30’ in length with some type of captive style carabineer securely fastened to one end) rope carried in a small throw bag or similar device attached to the search crewmembers SCBA or tool belt.

**CAUTION:** Personal search ropes (tag lines/branch lines) should not be permanently attached to your SCBA or any part of the personal protective ensemble incase you become entangled – *a quick release hook or breakaway Velcro connection should be considered.*

**Hand tools** – Members conducting a search line operation should always carry some type of hand tool to assist in the search operation. The most notable tools to be carried are a Halligan, axe, short pike pole or closet hook. It is strongly recommended that the control member (stationary at the guideline) carry the Halligan tool while all other search crewmembers should carry an axe, short pike pole or similar tool for probing, reaching, etc.

**Portable Radios** - If possible, each crewmember should carry a radio with a designated frequency/TAC channel for search line/Safety Engine/RIT search operations ONLY. Search line operations are very much dependent on effective communications, failure to use a separate frequency may cause critical information to be missed thereby jeopardizing the safety of operating personnel.

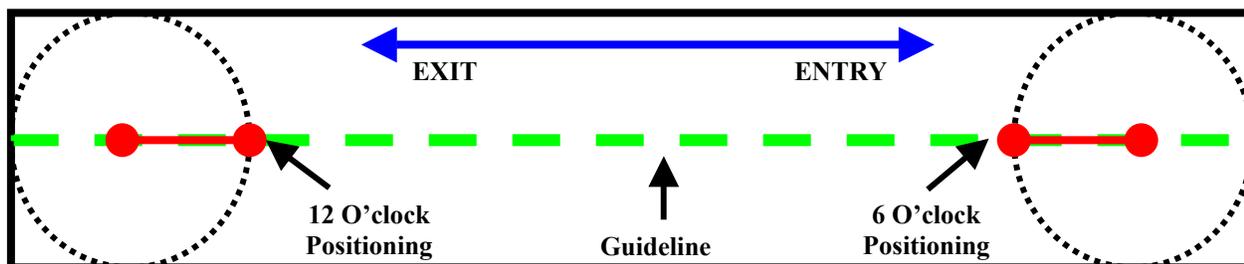
**Air Supply** - Additional SCBA cylinders should be readily available immediately outside the hazard/hot zone (preferably 45-60 minute capacity). Longer duration cylinders will enable crews to penetrate deeper into the building while at the same time conduct a more in-depth search operation.

## METHODS OF ORIENTATION

**Knot Systems** - Firefighter orientation is one of the most complex problems faced by the modern firefighter as he/she enters a smoke filled environment. The use of a “universal” knot system allows firefighters to identify specifically where they are and the direction of travel necessary to penetrate into the structure or exit immediately if necessary. The important point to remember with any type of knot system is that all members of your department and surrounding departments must understand it and be properly trained in it’s use.

- **Depth Orientation** – The system used in this training program uses a 20’ per knot increment ruling. Each knot located on the “entry” side of the attachment ring signifies 20’ feet. Two knots would signify 40’, three knots 60’ and so on.
- **Directional Orientation** – The attachment ring is used basically as a point of reference (can also be used for branch searches if necessary), once the ring is located the firefighter quickly slides his/her gloved hand up or down the line looking for directional knots, if no knots are felt, this signifies the direction of the exit, if a knot is felt after sliding his/her hand down the guide rope, this signifies penetration into the building (the number of knots will indicate the depth into the building i.e. 4 knots = 80’).

**Search Patterns** - Another common technique that can assist a firefighter in maintaining his/her orientation when using search lines is the use of standardized search techniques. The 12 O’clock starting position provides multiple points of reference when conducting a circular/360° degree search pattern. Anytime a firefighter attaches his/her tagline/branch line to the guideline for a circular search, he/she should be instructed to begin the search at the 12 O’clock position (The 12 O’clock position is the full extension of the search members tagline/branch line directly in line with the guideline - See below). By starting at the 12 O’clock position the firefighter is immediately oriented in his/her search effort, while at the same time he/she has a built in progress report marker at 6 O’clock (“Knot No. 4 to command, I’ve completed the left side search of Knot No. 4, I’m proceeding to the right side to complete my search of Knot No.4”).



**Building Geography** – Like any search effort, firefighters should attempt to identify items in the immediate area to help provide points of reference. Items such as furnishings, floor coverings, windows, and related building features provide a good method of orientation when using search lines. Firefighters should train on providing progress reports that include geographical references; this training will lead to better orientation skills for the firefighter and better overall accountability on the fireground for the incident commander.

**Oriented/Control Member** – Although one of the advantages of tagline/branch line search operations is that it’s somewhat an independent or a remote search operation that reduces the number of personnel needed to search a particular area, the buddy system is still a must. The use of a control member or oriented member enables firefighters to do remote, independent search operations while a second member stands by at the guideline/search line to assist with orientation, accountability and progress reporting.

## ACCOUNTABILITY / TRACKING SYSTEM

The proper tracking and accountability of operating personnel is of extreme importance when deploying search line operations. Fireground commanders must track the entry time of each participant (and establish a recommended time of exit – i.e. 15 minute work cycles), starting air supply pressure, number of personnel per crew and their location within the structure as an absolute minimum.



### **Time of entry/recommended time of exit –**

The time of entry is simply tracked by having crews notify the incident commander prior to entering the structure. The incident commander would then document the time on his/her accountability board and establish a recommended time of exit. A good rule of thumb is to use 15 minutes intervals for accountability and exit times when using cylinders rated at 30 minutes. Example: A crew enters at 13:15; their recommended time for a personnel accountability report (PAR) would be 13:30. At the same time, the incident commander would request an air supply reading and if necessary request the crew to exit. If the crew is unable to provide an air supply reading due to a lack of visibility, the crew shall be directed to exit as a measure of safety.

**Starting air supply pressure –** Documenting the starting air supply pressure enables the incident commander to establish a recommended exit time and/or work cycle. Although it should not be a common practice, some members may enter a structure with less than full cylinders, if this is the case, the incident commander should make the necessary notations and adjust his/her recommended exit time/work cycle accordingly. As previously stated, anytime a PAR report is requested, the incident commander should also attempt to obtain an air supply reading from the operating crews. If at anytime an accurate reading cannot be obtained the incident commander should direct crews to exit as a means of safety.

**Search crew location –** The search crew location should be accurately tracked based on progress reports and assignments given. The initial assignment may be to search Knot No. 4 (last known location should be reflected on the accountability board), once a progress report is provided, the incident commander should then update the accountability board to reflect the latest report (i.e. Team 3 to command, we've completed the search on Knot No. 4, proceeding to Knot No. 5). Although this course does not required the participants to perform specific search operations, the knots should be used as a means of tracking the participant's location within the structure.

**Area searched/area to be searched –** Another technique for proper tracking and accountability is to have the incident commander provide a detailed sketch of the search operation. By drawing a sketch of the search area, the incident commander can provide visual instructions to crews as they are deployed into the structure. Furthermore, by requiring the incident commander to use a tactical worksheet we again reinforce the use of another vital tool that is oftentimes underutilized on the fireground.

## COMMUNICATIONS

Pre-established communications policies and procedures/guidelines should be reviewed and reinforced throughout this training process. The use of "Emergency Traffic" request should be used throughout this and other training programs to reinforce personnel confidence and familiarity with the required steps and procedures to follow during emergent fireground situations.

The importance of correct terminology, tactical channel usage, progress reporting, and personnel accountability reports cannot be overemphasized. No incident commander regardless of his/her experience level or expertise can effectively manage an incident without an occasional progress report. Take the time to discipline yourself and your crew to provide the incident commander with the necessary information to ensure your safety and survivability. **Communication is absolutely essential. "Practice like your life depends on it, because it does!"**

## SEARCH LINE SURVIVAL TRAINING COURSE

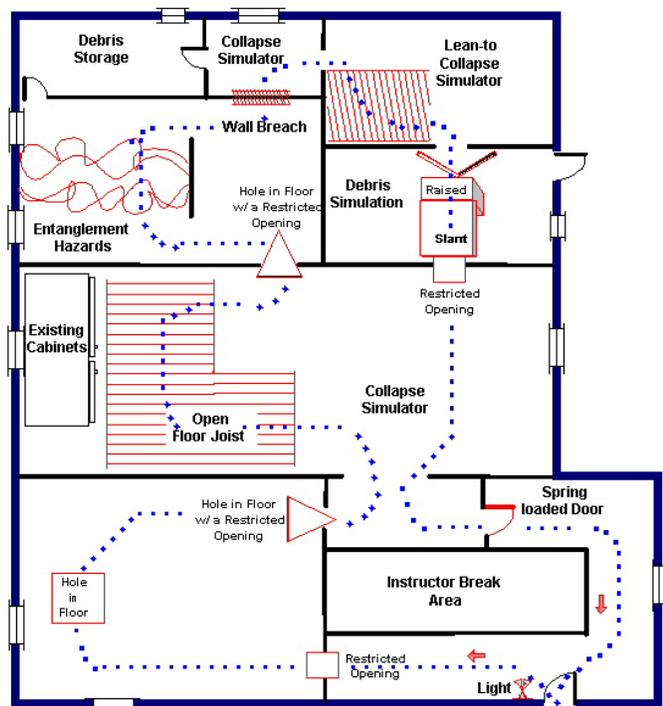
This search line survival course was developed using an acquired structure and minimal building supplies. Various obstacles were created by simply cutting holes in walls, removing various sections of floor materials, and constructing minimal props such as the collapse simulators, debris piles, door enclosures and entanglement hazards. To ensure that each participant goes through all of the pre-established obstacles, the search line was attached to the floor surface using quick release clips, which were purchased at the local hardware store.

**SAFETY NOTICE:** Prior to conducting this training program, an instructors meeting should be conducted with a detailed safety briefing to insure that proper supervision is provided for each participant and that potential hazards are identified and addressed accordingly throughout the course.

## SAMPLE COURSE

### INSTRUCTIONS/OVERVIEW:

1. All search crewmembers shall be required to wear their full protective ensemble including: helmet, gloves, hoods, coats, boots, protective pants and SCBA w/ a functional PASS alarm. Each participant will be provided with a 12" x 12" piece of wax paper to be placed inside his/her facepiece to reduce their visibility. The use of wax paper inside the facepiece provides for a more realistic smoke effect as opposed to a completely blacked out facepiece. By placing the wax paper inside the facepiece the potential for "accidental" visibility is also reduced.



2. Search crew participants shall work in teams of no less than (2) two and no more than (3) three.
3. Each search group shall be equipped with (2) two hand tools, preferably (1) Halligan, and (1) axe, closet hook or short pike pole.
4. Each search group shall be equipped with at least one (1) radio.

5. Participants shall follow the search line (*in descending order – i.e. start at Knot No. 9 and proceed to Knot No. 1. This simulates an EXIT Drill thus justifying the instructions to continue past the identified hazards.*) until they can go no further or until they reach the exit point. It is important to note, some participants may not complete the course in it's entirety, instructors must be prepared to provide immediate relief/rehab to those participants who stop throughout the course. **SAFETY NOTE: Do NOT force a participant to go beyond his/her personal limitations.**
6. Group leaders shall be required to give progress reports (Progress reports shall consist of: **C** – Conditions, **A** – Actions, **N** – Needs), hazard assessments, and personnel accountability reports (PAR) throughout the training session.
7. The Incident Commander shall request for a PAR/Role Call every 12-15 minutes. The use of shorter duration PAR checks during this training program has proven to be beneficial in the fact that participants get use to frequent PAR/Role Call checks and become less frustrated on the fireground where they experience longer durations between PAR/Role Call checks.
8. Search crewmembers shall immediately request “Emergency Traffic” when their low-pressure alarm activates. Once “Emergency Traffic” is requested and confirmed by command, he/she shall provide an immediate C.A.N. report (C-Conditions, A-Actions, N-Needs - i.e. “RIT Team 2 to Command, we are low on air, we’re attempting to reach Knot No. 2, we need two (2) SCBA’s set up at Knot No. 2.”). Upon receiving this information, the Incident Commander shall transmit this request (via radio) to the logistical support personnel (One inside instructor shall serve as the “Logistics Officer” and direct inside operations accordingly.) inside the structure. Upon receiving this request, the instructor serving as “Logistics” shall confirm this request and complete the task as directed.

**Note:** To enhance the IMS functions of this drill, consider requiring the Incident Commander to assign an Air Supply Officer who is strictly responsible for providing the correct number of cylinders to “Logistics” upon request. This remote activity not only lessens the down time for outside personnel, it also requires the acting Incident Commander to manage his/her resources more effectively while at the same time he/she must communicate specific instructions in order for the prescribed task to be completed.



Air Supply Officer inserts an SCBA cylinder upon the request of Command; logistical support personnel inside then place a fully charged SCBA at the specified location (i.e. Knot # 4) as directed by Command

Upon reaching the knot with the requested SCBA's, the search crew will then doff their expired packs and don the fresh packs, which have been provided. The key is to keep the crew moving throughout the course and to reduce there down time during SCBA change outs.

***CAUTION:*** This is not intended to be a recommended practice during low air supply situations, rather a means of quickly replenishing the participants air supply so he/she can continue with the drill.

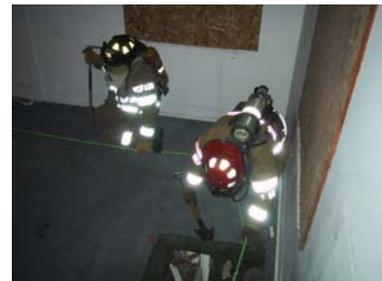
9. As search crewmembers encounter identifiable hazards, the group leader shall be required to notify command of their approximate location (based on the knot system) and the hazard they have encountered (Again, the crew leader should use the C.A.N. acronym when providing progress reports and conclude his/her report with a PAR count). The incident commander shall document this information and properly track the crews progress accordingly via the tracking/accountability system being used
10. The incident commander shall be responsible for tracking the crew's progress within the structure, individual entry times, exit times, personnel accountability reports and overall resource management. As an added benefit, logistical support personnel should be encouraged to occasionally contact command and request specific information such as; location of RIT Team 4. By doing this, we can determine the accuracy of our accountability system and the effectiveness of the operating Incident Commander. This should not be used as a means of embarrassing the participants, but rather as a learning tool.

## **BASIC COURSE OBSTACLES**

**Reduced/restricted openings** – The reduced or restricted opening in this course replicates those conditions, which may be encountered during various search and/or self-survival operations. The objective of this obstacle is to develop personal confidence in partial and full-escape operations when using an SCBA. It is also intended to teach the firefighter how to properly utilize the available space when encountering small or restricted openings.



**Holes in the floor** – The fireground is well known for its inherent risk, firefighters across the country routinely encounter obstacles such as holes in floors, weak or sagging floors and potential floor collapse situations. The objective of this obstacle is to teach firefighters how to use various hand tools to probe and/or sound the area in front of them to ensure its stability prior to committing themselves. Years of training scenarios presenting constantly stable floors have caused most firefighters to forget the importance of sounding floors and probing potentially hazardous areas with their hand tools. By training with these realistic hazards, firefighters are provided with lifelike situations and forced to react appropriately. It is not uncommon to have firefighters lose their tools in holes due to poor technique and expectations of stable floors.



**Open floor joist assemblies** – Firefighters face the potential of open floor joist or holes in floors routinely on the fireground. The objective of this obstacle is to teach the firefighter how to use his/her tool to help him/her navigate across the floor joist safely and effectively. By teaching firefighters how to use hand tools to assist them in overcoming these obstacles they are less likely to leave the tool behind. By simply turning the tool perpendicular to the floor joist, the tool



essentially creates a working platform that enables the firefighter to crawl across the joist assembly while maintaining his/her balance with the tool. An additional part of this obstacle is the fact that the firefighter changes direction midway across the floor joist requiring him/her to adjust their tool a second time. This change in direction requires coordination and constant communications with his/her partner to ensure both members navigate their way through obstacle safely.

**Collapse simulations** – The typical reaction of a firefighter when a ceiling falls is simply to stand steadfast or at most, mildly shrug his or her shoulders in hopes of deflecting the falling objects. Falling sheetrock is nothing in comparison to what may immediately follow. Incidents of truss and/or roof collapse are becoming more and more common on the fireground; firefighters must be taught what to do during these split second situations. The objective of this obstacle is to teach the firefighter to react once he/she notices signs/sounds of an impending collapse. Specific emphasis should be placed on locating a wall or opening, to take cover. Firefighters involved in collapse situations have little to no chance of survival unless they can quickly position themselves in an area of safety such as against a wall, under a stable piece of furniture or inside a door opening.



**Entanglement hazards** – As has been stated in numerous training sessions before, the need to feel confident in overcoming entanglement hazards is of the utmost importance. In this obstacle the firefighter is required to overcome a series of entanglement hazards and maintain his/her orientation with the search line. If appropriate, the firefighter may choose to go over top the entanglement hazard by using his/her tool to compress or smash down the hazards or to simply use a reverse swim stroke method to pass the hazards over his/her head.



**Wall breach operations** – As always, we want the firefighter to understand the importance of pursuing all avenues of escape. The incorporation of the wall breach obstacle reinforces this very important self-rescue skill. In this obstacle the firefighter encounters a wall with pronounced studs, based on pre-course instructions, the firefighter is instructed to follow the search line wherever it goes, in this case he/she must breach the wall to continue.



**Void space operations** – The frequency of truss collapse continues to haunt the fire service. This obstacle is designed to replicate the restrictive spacing commonly found in a lean to or “V” type collapse situation. Firefighters should be instructed to take advantage of the space available. This is best accomplished by placing the cylinder of his/her SCBA into the upper or lower corners of the collapse simulator. By positioning the SCBA in corner void spacing, more space is available for his/her shoulders to pass through the obstacle. This additional space may be all that is needed to successfully overcome the hazard.



**Navigating debris** – Regardless of our methods, fireground debris is abundant and oftentimes troublesome to navigate. This obstacle is designed simply to make the firefighter crawl up and over simulated debris while maintaining orientation with the search line. Important issues to address are how to navigate slanting surfaces, such as floor collapse situations. Much like descending stairwells, firefighters should be taught to descend feet first and use their hand tool to assist in controlling their descent when possible.



**Door control** – One final obstacle included in this training course is that of controlling your means of egress. The firefighter encounters a closed door that he/she must pass through in order to exit the course. The objective of this obstacle is to reinforce the importance of securing/chocking doors in the open position to ensure you have a means of egress.



### **ADVANCED COURSE OBSTACLES:**

Over the past year and half of doing this course we have continued to develop new ideas and instructional methods to enhance a firefighters performance and confidence in search line operations. The following are some more advanced obstacles to consider:

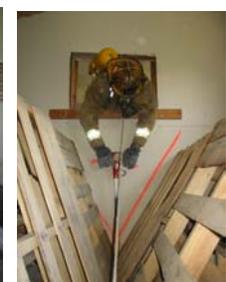
**Spring loaded floor assembly** – This particular obstacle requires the firefighter to enter the course through a triangular opening to an angled floor assembly that is equipped with springs. Once the firefighter places his/her weight on the floor it immediately drops a short distance. The key to this obstacle is to see how the firefighter reacts to the changing conditions and to see what information he/she communicates to his/her partner.



**The 4-Leaf Clover** – While the 4-Leaf Clover obstacle does not directly replicate any particular obstacle on the fireground, it once again causes the firefighter to assess the provided opening and adjust accordingly to its particular shape. A good assessment of the opening will allow most firefighters to pass through head first without the removal of his/her SCBA.



**High / Low Passages** – The high / low passage is designed to require the firefighters to use their tools for navigation and probing as much as possible. By making firefighters climb a series of debris piles and then enter a restricted



passage, tool navigation and probing become second nature.

**Close Quarters Maze** - Communications is one the most critical factors for search line survival training and directional changes require firefighters to provide detailed instructions amongst crew members. This close quarters maze requires the firefighter to change directions very abruptly and often; not only will this test their patience and persistence, but it also generates some creativity in how to best describe the pathway to their respective crew.



**High / Low Ramps** – Firefighters have been taught to navigate downward slants and stairs feet first, but seldom do they do so because of fatigue and the general inconvenience on the fireground. These obstacles require teamwork, effective communications and a degree of creativity to safely navigate.



**Scuttle Ladder Climb** – While I would assume the practice of search lines proceeding up a ladder would be a rarity, this ladder climb obstacle has proven to be extremely educational in teaching firefighters how to follow/navigate a search line. Firefighters in this obstacle are led into a tight space beneath a stairwell where the search line terminates at a 90° angle up the ladder. Firefighters are then required to climb the ladder and proceed to the second floor. Complications are quickly noted in how to balance their tool, maintain contact with the search line and assess potential hazards overhead.



### **SUMMARY:**

The use of search line operations in the fire service has become increasingly common. As instructors, we must seek out new and innovative ways to insure the safety and survivability of our members during these operations. This search line survival course has been designed to be a multi-faceted training program that meets the needs of senior fire officers, company level officers and firefighters alike. Few if any training programs have been found to be more effective in developing the necessary survival skills for this type of operation.

The limitations are few, the rewards are many, so I challenge you to put forth the effort to test your members both physically and mentally in hopes of increasing their personal confidence and overall safety & survivability on the fireground.

### **DEDICATION:**

As I conclude this program, I would like to express my sincere thanks to Anthony Avillo, Mike Nasta, Shane Ray, Curtis LeGrotte and the members of Missouri City, Texas, Pleasant View, Tennessee, and Kansas City, Kansas Fire Departments for sharing their expertise and

experiences through the published articles and personal training efforts during the development of this program.

This program is dedicated to ensuring that we the fire service learn from the past in hopes of providing a safer future.

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#### RELATED INVESTIGATIVE REPORTS:

- National Institute for Occupational Safety and Health (NIOSH)(2000, Sept.) *Death in the Line Of Duty, Report 99-F-47*
  - *Six Career Firefighters Killed In Cold Storage and Warehouse Building Fire - Massachusetts*
- National Institute for Occupational Safety and Health (NIOSH)(2000, Nov.) *Death in the Line Of Duty, Report 99-F-48*
  - *Warehouse Claims the Life of a Battalion Chief – Missouri*

#### PROGRAM DEVELOPER:



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The recipient of the student’s choice *Instructor of the Cycle Award* from Kansas City, Kansas Fire Department in 1995 and *George Hughes Award* from the Texas Association of Fire Educators in 2001, Tim is currently the First Vice President of the ISFSI and a student of the National Fire Academy’s Executive Fire Officer (EFO) Program.

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