FIREGROUND RESIDENTIAL SEARCH PRINCIPLES and APPLICATIONS

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In the fire service it has been ingrained in us that almost every structure should be searched for the possibility of the presence of civilians whether known to be within a structure or not. The decision making process relating to the presence of occupants and their need of rescue is one of our main responsibilities on the fire ground. To carry out such a precarious task requires extensive training along with sound size-ups and related experiences in search from one structure to another as well as from one fire to another. Every situation requiring civilian search is presented to us very differently from one residential fire to another. The training and experience that is put into practice requires specific strategies and tactical maneuvers for the optimal success in saving lives while also protecting our firefighters doing the searching. Some principles and methodologies are listed below.

- **Risk versus benefit relating to survivability for both civilian and firefighter.**
- **Sound search size-up's prior to and during searches relating to life occupancy and priority areas.**
- **Search tools**
- **Size and experience of search teams.**
- **Search techniques and applications for various types of searches.**
- **Accuracy and speed of primary searches and secondary searches.**
- **Applications and door control with both conventional searches and VEIS type searches.**
- **Searches and fire flow paths.**
- **Applications for victim rescue and removals.**

The above basic principles and techniques should be part of the decision to commit firefighters in performing search in the interior of any structure. It is one thing to search a structure looking for life during your movements while then coming across a victim and now facing the additional challenges of rescuing the victim. The mere act of removing a victim through high hazard environments provide the opportunity for firefighters to deplete their air supply while also getting confused or disoriented through the acts of positioning and moving the victim.

Searching is one thing and has a whole set of accountabilities and communications to be in control of during a swift and accurate primary search. Once victims are found depending on their level of mobility meaning conscious or unconscious will demand specific control and techniques to extricate the victim as well as for firefighters being able in extricating themselves. The whole process of search and rescue no matter what type of search you are conducting requires diligent communications within the team searching as well as to outside incident command. Firefighters must also be able to establish as best as possible under many times zero visibility conditions a search that is orderly and complete to the best of their abilities. During their chosen search patterns the additional burden of staying oriented is the other major challenge.

The initial common training techniques taught to recruits and rookie firefighters is just a basic foundation regarding staying in contact with walls and the direction of your search such as left or right. This is fine for the introduction of search and tool usage but it will never provide for what is to come in the true residential environment. Further training and experience will soon provide to the seasoned firefighter that these early training methods in search are to slow wasting valuable time of which is usually not in great supply. Victims are in need of immediate assistance and firefighters need to move quickly into a structure while threatening fire conditions could possibly be escalating limiting the survivability profile. The movement of firefighters searching needs to be quick and as expansive as possible and staying stuck to a wall is not conducive to good searches nor is it possible to stay in contact with a wall due to room layouts and furnishings throughout any given area of a residential structure. When proper search methods are performed within a given structure along with highly probable expectations that victims are present and in need of rescue the better the chances for their survival. Search patterns that are performed by wanting to stay on a wall will leave little to be desired in covering a room or area properly.

The most highly probable location of occupants in a residential structures especially during evening or early morning hours are the bedrooms and common passage ways to and from these areas. Searching these areas should incorporate methods that utilize a systematic and rapid movement through a room while performing primary searches. Most bedrooms can be given a solid primary search within 20 -30 seconds allowing for one rescuer searching while another rescuer is monitoring at the entranceway of any room. The rescuer at the door is providing orientation through a verbal presence while also monitoring fire conditions and a plan for an exit strategy with or without a victim given the possible need for rapid egress.

Contributing Factors In Sound Search Methods

- **Location of possible victims through reliable and probable information.**
- **Type of room being searched.**

- **Maximum of two firefighters, one searching/one monitoring.**
- **Moving into the room towards the swing side of the door.**
- **Placing your tool at the door or on an angle on the inside of the wall opposite the swing side of the door.**
- **If fire conditions are threatening control and close the door to protect the search.**
- **Incorporate window ventilation with door control in a room when appropriate.**
- **When utilizing VEIS control the door by closing it.**
- **When searching in bedrooms sweep the bed and around the bed along the floor.**
- **Sweep underneath the bed if there is a void space.**
- **Bunk beds should be searched at the highest level first and then down to the next bunk and then underneath the lowest bunk at the floor.**
- **Do not move the bed or mattress to search under it.**
- **Monitoring firefighter should provide illumination with a flashlight at the door.**
- **Both firefighters are to remain in good voice contact when visibility is limited.**
- **If no victims are found close the door when leaving when needed for the affects of fire flow path.**
- **When performing VEIS in limited visibility or threatening fire conditions limit the search to one room and then exit back out the window onto the ladder.**
- **If and when victims are found immediately notify the IC while also asking for additional help and the intended path of travel to the exit chosen for both firefighters and victims.**

There are many tactical and performance techniques that should be acquired and applied to searching for civilians in residential structures. Firefighters through various experiences during searches and at search training drills are always coming up with new and improved maneuvers to help improve communication, accountability and orientation in near zero visibility environments. Experience at live residential fires requiring searches should focus in on high life hazard areas within these structures while accounting for fire conditions, fire flow paths and egress. Civilians are found in the following areas within residential structures whether conscious or unconscious.

Probable Distressed Victim/Civilian Locations within Residential Structures

- **Just beyond entry and exit doors.**
- **Behind the swing side of doors.**
- **Common passage ways leading to rooms or staircases.**
- **Bedrooms with probabilities higher in the evening and early morning hours.**
- **Bathrooms seeking protection thinking that water is available to protect them.**
- **Closet areas for children.**

- **Nursery rooms.**

While entering structures into these areas firefighters should be bringing with them the appropriate tools that are conducive for search. As part of our search training and through performing in actual events the use of hand tools becomes very important in how we use them. It should be noted that even though we use tools for probing and sweeping it still requires that the firefighter search confirms victim locations through investigation with a gloved hand. Bottom line hands locate and find distressed civilians not a tool. Depending on the type of search and the residential structural features should dictate the tools we use. The following tools for search and rescue are the required basic elements for search and firefighter survival.

Tools for Search and Survival

- **Full PPE/SCBA**
- **Portable Radio**
- **Halligan Bar/Axe/Irons**
- **2 Flashlights**
- **Thermal Imaging**
- **Looped Webbing/Drags/Survival**
- **Hose line protection**
- **Ladders for VEIS/Ingress and Egress**
- **VEIS NY hook 6ft when applicable.**
- **150ft Small Diameter Rope Bag (Structures Complex or Over 3000 sq. ft.**

The tools listed above will help not only the search techniques we use but also the survival probabilities of civilians and firefighters alike. Tools enable us to probe ahead and provide extension into rooms and off walls. They help us locate objects of interest they may turn out to be victims when investigated off the tool with your gloved hand. Improper use of tools for search can also result in injury to victims as well as firefighters while moving them with us through a structure. Tools can help us extend further into a room through anchoring methods but these kinds of techniques will only provide limited searches of rooms because they cannot provide for a complete coverage of an entire room. One of the most applicable tools for search is the Halligan bar but it should be used appropriately. The Halligan bar has not only versatility but it is considered to be a survival tool as well for the searching firefighter. The Halligan bar because of its design and weight should be dragged along the floor with the adz and the pike forward resting on its points with the fork is facing back. It should be gripped by the hand in the middle of the bar as to keep your knuckles off the floor while moving it along the floor. This method is important to use when visibility is poor. Trying to wave it around in front of you is not only ineffective but also tiring not to mention that the pike and adz could seriously injure

the civilian as well as the firefighter who maybe unaware of the contact of the pike and adz to the victim as well as himself. The ax is another prominent and comfortable tool used in search and should be used by holding the ax head and blade with your gloved hand with the long handle pointed ahead of you. Any tool that is used for search should be regarded as a locating tool as well as its ability to be used for survival means such as breaching walls, forcible entry and possibly as an anchoring tool for bailouts.

Learning how to search certain furnishings and the arrangements of furnishing takes not only practice through training but also by what has been gained through experience under fire conditions. Searching king beds, queen beds, bunk beds, under windowsills, different closet types all have their unique challenges in near zero visibility. Carelessly throwing or moving furniture around is an inappropriate tactic when searching. This will not only pose problems by covering areas that have not been searched yet but it also destroys the position of certain landmarks that allow searching firefighters to be able to return from once they came. Furnishings that have been placed within residential structures allows searching firefighters to extend their investigation of areas further into the room while being able to get back to a wall when necessary by mentally mapping a room and your placement in it.

Searching in zero visibility for long periods of time create increased risked to firefighters as well as lowering the threshold for victim survivability. When rescuers that are searching have the ability to ventilate it should be done as soon as possible which will increase the speed and accuracy of the search. Even when rescuers have the ability to ventilate the flow path of fire and smoke should be taken into thoughtful consideration especially when searching without a hose line either brought in by the search team or by an engine company making a good advance on the fire and its extinguishment. This along with top side ventilation when possible will improve conditions for all firefighters and civilians that are inside the structure.

When searching for civilians under fire conditions it is best for the firefighters searching to try and get to the area closets to the seat of fire when possible. When an engine company is advancing a line to the fire it has the capability of searching but only after they have arrived at the seat of the fire. While the nozzle man holds the fire in check then and only then can a search be conducted off the hose line. It is imperative to understand that a primary search that is trying to be conducted while members are advancing a line to the seat of the fire that a proper primary search would be unobtainable. Coming across a victim while advancing a line requires a whole new set of strategies in order to keep the line moving while trying to move and rescue the victim to the outside or to hand off the victim to another assisting company. This allows for a few results that will improve the search and the survivability of occupants and firefighters. First will be the increase of visibility in the areas closest to fire to be searched due to flame producing light. The other is that it provides for getting to the area where victims are

most threatened from the hostile environment while moving firefighters further away while they progress their search back towards their egress points. Search teams that move in ahead of hose lines can also find fire utilizing radio communications to incident commanders and engine companies as to the exact location and direction of travel to the seat of the fire. When these types of maneuvers are employed they carry a greater risk to those searching but they may also help in executing complete primary searches along with improving earlier fire control and scene stabilization. Searching firefighters must try to provide a well paced complete search that is swift while always being conscious of dramatic and changing fire conditions that can become out of their control from once they first entered the structure.

Fire Flow Path and Search

Most of our training over the years involving search encompassed searching under fire conditions that existed years ago with more natural furnishings and legacy construction methods. Today's fire environment has drastically changed as we know since then. Our training in regards to search is usually done under the simplest of conditions utilizing class "A" materials resulting in fires that are based on minimal fuels limiting high heat release rates along with rapid fire spread. The modern day structure fire is usually ventilation limited with high heat release rates with earlier incidents of flashover and collapse. The search methods today need to be addressed with the idea of the types of searches and the location of searchers to the relevance of a fires flow path that existed prior to our arrival as well as the flow paths we create during the fire. Search maneuvers are usually taught or incorporated as one firefighter searching within a room while another firefighter or fire officer stays into the open doorway monitoring fire conditions in the surrounding area while also monitoring the searching rescuer. Due to the recent studies regarding fire flow path it may be sometimes better to have the searching rescuing searching with the door closed while the monitoring firefighter is outside a closed door waiting for the searching firefighters return. Protecting the search is the optimal concern for both the civilian and the firefighter from smoke and heat whenever possible. Most civilians because of lack of protection in wearing PPE and SCBA that firefighters wear sir come to smoke inhalation. By providing door control with the door closed may buy more time for the occupant and breathing air while also possibly limiting a fires flow path to the searching area. These concepts along with the use of thermal imaging and a good hand light will allow the rescuer more accurate and longer distances to be seen during the search.

Primary searches incorporating 2-3 rescuers require searchers to work off of the walls in most cases allowing rescuers to reach and feel further into room centers increasing the chances of identifying and rescuing victims. Proceeding to rooms closest to the fire every attempt should be made to close the door to the fire room in an effort to isolate it and delay the affects of fire flow path. From this point the searchers would search systematically as possible the rooms

closest to the fire moving to the rooms furthest from the fire area. The idea of this process is based on those exposed to the most endangered or threatened areas of victim survivability factors. If we consider searching under fire conditions in residential structures with open areas and hallways in line with flow paths will be the most dangerous areas for firefighters to be in due to flow paths creating higher temperatures and increasing fire conditions based on previous ventilation openings or newly created ones. Fire officers controlling the searches are better off monitoring these areas with flashlights and thermal imaging while searching firefighters search behind closed doors. Just before firefighters enter the rooms to be searched the control firefighter should allow for both him and the searching firefighter to scan the room with the thermal imager. The control officer should then allow the searching firefighter to enter the room to begin the search while closing the door and controlling the door. This may also allow for the searching firefighter within the room to possibly ventilate a window for increased visibility and survivability for both he and the victim. The control officer can periodically open the door monitoring the search as well as monitoring the hallway areas for smoke and fire conditions and the affects of fire flow path. If for any reason a door cannot be controlled then ventilation would not be advised.

Tactical VEIS Considerations in Search

The tactic of VES/VEIS has long been associated with searching above a fire through window entries at residential fires while bypassing the use of the interior stairs. The tactic of VES can be very valuable and it has been proven to save many civilian lives but it also has been known to endanger the lives of firefighters when applied inappropriately. VES should not replace the conventional search methods within the interior of a structure by entering the home at ground level which can be more productive in covering many areas within a home. When performing searches through more conventional methods many bedrooms and other areas can be covered versus VEIS providing possible only one bedroom or area to be covered. This is because during VEIS procedures firefighters would have to return to the ladder and descending the ladder to reposition it to another window to repeat the process for another bedroom or area. Fire flow path and door control are the new features from several studies that cannot be ignored even though we have been using these techniques and their concepts for many years. The considerations that should be taken into account when performing VES/VEIS which predominately involve breaking windows must be weighed against its possible unintentional ill effects for civilians and firefighters alike. The biggest considerations in performing this tactic are fire location, time, fire flow path and wind. We now know and realize that due to modern day light weight construction and residential furnishings burning faster and hotter will affect fire flow path to travel unbelievably fast to any given ventilation point. The decision to break a window many times is performed by firefighters using several different methods. Some methods are more advantageous than others and carry with them techniques that are not the

best applications to what others consider best practices when venting upper floor windows when conducting VEIS. Depending on the method chosen to vent the window once broken the countdown begins with the fires flow path. The time it may take firefighters to get into the structure due to masking up, gathering tools and getting up the ladder and then clearing the rest of a window out may have allowed the fires flow path to have arrived to quickly into a room or area making the search more compromising. With these concerns regarding time and the fires flow path the following most common methods that firefighters employ when venting windows for VEIS are listed below along with their advantages and disadvantages through best practices.

- **Ladder windowsill ventilation:** Ladder placed rescue position just below the sill with firefighter placed on the ladder head just below the sill while breaking the window with a tool. **Advantages are**: ladder in ready position for VEIS entry, Firefighter protected from outward flow of smoke and fire by being just underneath the sill, reflex time getting into the window very short. **Disadvantages:** Possible broken glass and window materials falling onto the firefighters head, hands, wrist and forearms. **Considered Best Practice.**
- **Conventional Window Ventilation:** Ladder placed to the left or right of the window for wind conditions with firefighter on the ladder reaching out clearing the window out with a tool: **Advantages:** Firefighter protected more fully by the wall adjacent to window, products of combustion smoke and fire venting away from firefighter more completely, avoids broken glass and window materials from falling onto firefighters head, wrist and forearms. **Disadvantages:** Ladder not in ready position for rescue position below the windowsill and needs to be repositioned, Reflex and fire flow path time increased, longer delay on entry delaying rescue and control of the interior door. **Not a Best Practice.**
- **Ladder Window Break Ventilation:** Firefighters use the beam side of ladder angling it into the building to break the window and possible sash. After the break the ladder is pulled back to a position just below the windowsill ready for VEIS entry. **Advantages:** Firefighter protected from expulsion of products of combustion, fire and smoke because they are on the ground, ladder can quickly be repositioned to just below windowsill, shorter reflex time than conventional methods. **Disadvantages:** Possible falling glass and debris onto firefighters performing this method, possible damage to the ladder, the need to ascend and clear remaining window area, ladder possibly getting caught or snagged by window framing and window treatments. **Not a Best Practice**

With any of these procedures or techniques VEIS can allow fire flow path to affect the area of the vent from an open interior bedroom door before we are able to get to the door to control it. Nonetheless are job is to save lives when lives are in the balance. The risk is great for both

firefighter and the civilian but the reward is greater even if a discovered victim has possibly not survived. The recovery of a family's loved one is without question something the family and the searching firefighters hold dear to their hearts. Fire flow path should not deter our efforts in saving lives. When firefighters are utilizing VES getting up the ladder and into window and into the room it has to be timely. Firefighters should train on getting in and out windows while also training on breaking windows whether breaking them with a ladder or while they are on a ladder. Getting in and out of a window with an SCBA on along with tools can be difficult. Depending on conditions firefighters may straddle into a window or even belly down over the windowsill while getting in. The techniques and concerns when entering windows under VES applications are listed below.

Techniques and Concerns during VES/VEIS Operations

- **Are the interior stairs more applicable?**
- **Decision to use a ladder to force/break the window vs. working on a ladder to clear the window. You still will have to do both.**
- **Be careful when sounding the floor with a tool a victim may be present just below it.**
- **Enter by straddling or belly down techniques depending on conditions.**
- **Control your tools.**
- **Use tools to extend yourself from the windowsill into the room.**
- **Leave tools at the window on an angle to help in knowing your return to the window in zero visibility.**
- **Quickly get to the door of the room for door control.**
- **If conditions permit search just beyond the door into the immediate hallway.**
- **Close the door to the room and begin a systematic search of the room.**
- **If a victim is located communicate to your partner as well as the IC.**
- **Call for additional help.**
- **If no victims are present leave the room through the window you came through onto the ladder and then to the ground.**
- **Rotate the ladder against the building to the next window and continue the above process listed.**

From the list above one of the most important areas of focus is on ventilating the window with a ladder to access a floor above. Radio communications with fire companies advancing a line for extinguishment is very important and should be another consideration in coordinating search with line advancement. Venting an upper floor window may provide some lift and heat release for advancing hose lines but it may also draw heat and fire to the vented windows location. A judicious design process must be made in a very faced paced dynamic environment when lives are in the balance.

The Search Dynamic Into Below Grade and Half Grade Basements

The search dynamic in basement fires is nothing short of treacherous if attempted without a hose line and water application prior to descending the basement stairs. These fires and the search for occupants in these areas need to be addressed much differently than other coordinated behaviors on the fireground at structural fires. It is next to impossible for searching rescuers to expect positive outcomes when we are dealing with few options regarding the intense fire flow paths that are present at these types of fires. Exposing oneself to the hot gases, smoke and flame while trying to descend the basement stairs is not practical. It is not tactical to assume that the possibility of occupant survival is limited to positive outcomes. The probability in putting searching rescuers into harm's way is very high due to exposure and crumbling conditions of the interior basement stairs usually being burnt from the underside from fire impingement.

There are several reasons and concerns why primary search in basement fires should be cautiously attempted or even avoided until the fire is under control. One factor is the storing of combustible products that are many times found in basement which increases high heat release rates along with fast moving fires; this along with gas and electrical services that are present and not under control when these fires occur. Additionally the storing of various items and clutter that may be present making it extremely difficult for search crews to navigate and being able to reference exit strategies to many times the only way out of the basement which is the stairs. Basement access is limited and so is egress for any search group attempting primary search especially before fire control is established. Again to repeat our selves again no attempt should be made to save lives in basements under fire conditions without the presence of a hose line and its water application to the main body of fire. If there is another access point such as an exterior entrance such as an outback this would be the correct avenue for both hose line crews as well as searchers.

When it comes to basement fires the only strategy of consideration based on fire conditions is to apply ventilation and water application from the exterior before any attempt is made to go down the interior basement stairs as well as applying streams from other exterior entrances before entering these confined areas. This applies to both engine crews and search crews. Additional support should always support the idea of 2 operating hose lines that can both be used for exterior knockdowns and front door advancements to the interior basement stairs providing protection for all strategies involving extinguishment and search not only for the basement but the rest of the structure above the fire as well. Like most searches for occupants basements can create some of the most hostile searches to rescuers just as VES and searching above the fire can.

All the avenues regarding the strategies and tactics of search require sound decision principles in knowing where victims are located and the probability of survival along with search training. Train as often as you can within vacant buildings and acquired structures. Set up scenarios with realistic environments including furniture settings along with near zero visibility through the use of smoke machines or smoke barrels. By training we can increase the odds of finding and locating victims while also facilitating their rescues.

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