

SECTION 9 - SEARCH

Task force personnel must conform to an accepted system for victim search strategy and tactics in order to be effective. All personnel must have a solid understanding of the general search protocols and supervisory personnel must tailor the general strategy and tactics to fit the specific problems encountered.

Standard search strategy and tactics will result in:

- Reduced potential confusion of responsibilities.
- Better task force resource utilization and coordination.
- Smoother work site engagement and disengagement.
- Improved confidence in the search operation.
- Detailed documentation of the incident operations.
- Increased safety for rescue and search personnel.

Organizational Structure

A task force may be divided into several search squads, generally consisting of a Search Squad Officer, a Technical Search Specialist, a Hazardous Materials Specialist, Rescue Specialists, and a Medical Specialist. If available, Canine Search Teams (Handler/K9) can be assigned to each search squad. If two or more Search Squads are deployed, they should be managed by a Search Team Manager.

Safety

Search Squads are often the first groups to enter a disaster area. As such, it is extremely important that those personnel carry equipment to monitor and mitigate utilities, as well as monitor air quality. Structure stability and the potential for secondary collapse should also be closely monitored.

SEARCH OPERATIONS

One of the initial decisions that supervisory personnel may have to make will be what area should be searched first, as there may be many structures damaged that need attention. There are two general strategies that can be used to decide how to deploy search resources. An area may be sectored by city block or other easily definable criteria. Available search resources would then be divided and assigned to each sector for search operations. The sector strategy may work well for smaller areas but would most likely be impractical for larger areas, because of limited search resources on the scene initially.

Another method is to determine the search priorities based on the type of occupancies affected. Those that present the highest likelihood of survivability in terms of type of construction and the number of potential victims would receive priority. Occupancies such as schools, hospitals, nursing homes, high rise and multi-residential buildings, office buildings, etc., would be searched first. The chart below provides information that might be used to estimate the number of potentially trapped victims.

Number of Potentially Trapped Victims

Based upon building area	Occupants	Range
Public assembly	1 occupant/25 sq. ft	(or 10 - 50 sq. ft)
Schools	1 occupant/70 sq. ft	(or 50 - 100 sq. ft)
Hospitals	1 occupant/100 sq. ft	(or 50 - 200 sq. ft)
Commercial	1 occupant/100 sq. ft	(or 50 - 200 sq. ft)
Office/government	1 occupant/150 sq. ft	(or 100 - 200 sq. ft)
Public safety	1 occupant/150 sq. ft	(or 100 - 200 sq. ft)
Multi-residential	1 occupant/200 sq. ft	(or 100 - 300 sq. ft)
Industrial	1 occupant/200 sq. ft	(or 100 - 300 sq. ft)
Warehouse	1 occupant/600 sq. ft	(or 400 - 900 sq. ft)
Based upon type of occupancy:		
Schools	25 - 40 students per classroom	
Hospitals	1.5 occupants per bed	
Residential	2.0 occupants per bedroom	
Other/unknown	1.5 occupants per building parking space	

Search Phases

There are generally five phases of organized search and rescue operations at collapse incidents:

- **Phase 1:** Assessment of the collapse area.
- **Phase 2:** Removal of all surface victims as quickly and safely as possible.
- **Phase 3:** Search and rescue of victims from accessible void spaces.
- **Phase 4:** Selected debris removal to locate and rescue victims.
- **Phase 5:** General debris removal. Usually conducted after all known victims have been removed.

Recon Operations

- Identify buildings
- Structure/hazards marking
- Area/building search
- Search/assessment marking
- Assess void space and atmospheric conditions
- Victim location identification
- Sketch search area and record information
- Communicate findings to appropriate manager

This information can be recorded on the Site Assessment form and/or the Structure Triage form.

General Considerations

The most effective search strategy should blend all viable tactical capabilities into a logical plan of operation. The combined use of physical, canine, and electronic search tactics will enable the task force supervisors to better establish priorities and focus on the most important rescue activities. **It is always important to establish whether or not the team is involved in a rescue or recovery.** It is also essential that every possible search method be employed to enable task force supervisory personnel to locate viable victims before committing rescue resources to any prolonged operation.

Structure Specialists (building engineers) may also be needed to provide initial assessments of building stability and safety. An important consideration during a mission is the need to reassess previously searched structures. If the profile of a building/structure has been significantly reduced because of debris removal by heavy equipment or secondary collapse, it may be necessary to treat the structure as a new opportunity, and repeat the various search procedures.

Work Site Search Prioritization

Once a specific work area has been determined or assigned, the search tactics should be determined. The canine search can usually provide the most rapid assessment of a work site area. This capability might be used first to sweep an area for general indications of victims. A redundant check of a find indication by a second canine team should be used to ensure the greatest degree of credibility of the find. This location should be marked with surveyors tape or spray paint if the search team moves on.

The electronic search capability may be used in conjunction with the ongoing canine search, or afterward. The electronic search will usually be slower and more time

consuming. The selection of an electronic search site could result from prior indications of the canine search teams or be based on the types of construction/occupancies affected. Rescue personnel can be used to assist the canine and technical search personnel with safety assessments at collapse sites, gaining access to difficult areas, deploying equipment, etc. These personnel could also conduct physical search operations. Once a reliable indication of the general location of a victim is made, the use of the electronic viewing equipment may prove useful in precisely determining the exact location and orientation of the victim.

Canine Search

A properly trained search canine can cover large areas in a relatively short period of time. Due to their keen sense of smell, the canine can sometimes detect unconscious victims beneath the debris, including persons who may be incapacitated. The Kansas Search & Rescue Dog Association (KSARDA) is part of the Kansas Search & Rescue Response Plan and will be deployed by KDEM to assist with disaster search operations. It is generally best when one canine search team searches an area or building, and the second canine team then confirms any find.

Electronic Listening Devices

State-of-the-art electronic listening devices can extend the range of the search by detecting sounds from victims. Technical Search Specialists (TSS) use electronic acoustic/seismic listening devices to determine areas where search cameras can be used effectively. Electronic search operations are usually more site-specific and longer in duration than canine search operations. Application of the acoustic/seismic device involves the deployment of an array of two or more probes around the perimeter of a building or void area. Once a victim location has been identified, the array of probes may be redistributed around the area of the original probe giving the strongest indication, to more precisely identify the victim's location.

Electronic Viewing Devices

Electronic search cameras provide another capability for the search function of the task force. Used in conjunction with concrete hammer-drills is quite effective at pinpointing the exact location of victims. Experience has shown success with rescue personnel drilling an array or series of holes and a TSS subsequently following along with the search camera.

Physical Search

This includes deploying personnel over and around a collapse site. These personnel can make separate visual assessments in voids and confined spaces for any indication of victims. They may also be used in a coordinated fashion as an array of listeners. This operation is less accurate than the others and poses a significant risk to the personnel involved in the operation. Each search squad should carry a bullhorn to attempt communications with trapped victims.

The following list outlines the current tactics available for locating trapped victims, along with corresponding advantages.

<u>Tactical Operation</u>	<u>Advantages</u>
Physical void search	Does not necessarily require (visual/vocal) specialists, canine, or sophisticated electronic equipment. People could quickly be trained (and supervised by task force personnel) to support the effort.
Audible call out/knocking method	Same as above. Personnel can inform victim of expected response. This procedure can be modified and used in conjunction with listening devices.
Use of electronic viewing devices	Provides the general position and condition of the victim. Can be used to verify other search tactics prior to commencing rescue operations. Can be used to monitor victim during rescue operations.
Infrared/thermal imaging	Equipment is sometimes readily available locally. Can be used to survey large, open, dark areas.
Use of electronic listening devices	Able to cover larger search areas and sometimes triangulate on victim position. Capable of picking up faint noises and vibrations.
Use of search canine	Can search large areas in short period of time. Can traverse or gain access to voids and other opportunity sources.

The following list outlines the current tactics available for locating trapped victims, along with corresponding disadvantages.

<u>Tactical Operation</u>	<u>Disadvantages</u>
Physical void search	Limited access to all voids in (visual/vocal) building. Proximity required is dangerous to search personnel.
Audible call out/knocking method (rescuer hailing method)	Unconscious or physically weak person cannot be detected.
Use of electronic viewing devices	Extended or inaccessible voids (observation holes) cannot be viewed due to the flexible nature of the fiber optic cable and the limited light source. Limited penetration of the equipment.
Infrared/thermal imaging	Unit cannot detect heat differential through solid mediums. Sources of heat other than persons buried under debris are also indicated which creates confusion.
Use of electronic listening devices	Unconscious person cannot be detected. Ambient site noise is intrusive. Victim must create a recognizable sound pattern. Range is limited (acoustic - 25 feet, seismic - 75 feet).
Use of search canine	Extent of operation is limited; performance may vary according to individual handler and canine capabilities.