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*Fire Engineering*

**TIPS FOR USING THERMAL IMAGING CAMERAS**

The thermal imaging camera (TIC) is the latest tool in the arsenal of firefighting equipment. Its ability to detect heat signatures and transfer them into a viewable image makes it an invaluable tool.

Firefighters are now entering farther and faster into the heaviest smoke as they search for victims and the seat of the fire.

The TIC, however, can warn firefighters only of the dangers the cameraman can detect and recognize. It is of little use if the operator does not know how to use it.

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**ATMOSPHERE WITH ZERO VISIBILITY**

When entering an atmosphere that has zero visibility, look for the following.

- Before entering a room, adjust the camera's focus. (Some models use a gain adjustment

or throttle control to adjust the iris, a mechanical aperture that controls the camera's focus. The iris can be opened or closed manually to control the amount of infrared energy that enters the camera.) This is important. Adjusting the focus will sharpen the image and make the room's contents, conditions, and dangers more recognizable. Begin your scan by starting at the ceiling. Look for the signs of flashover and rollover. High heat buildup, sporadic flashes of flames, and heavy billowing smoke are preludes of flashover. Rollover appears as a rapidly moving wave of flame that spreads across the ceiling. Observe the heat line, and make a mental note of how far down it comes. The heat line is a noticeable temperature difference of heated air at the ceiling level. It first spreads horizontally and then begins to bank down, pushing firefighters down on their knees and then on their bellies. You can see it clearly after the fire by noting where the paint on the wall has and has not blistered.

Check this often to see if conditions are improving or worsening. Conditions inside the fire building should improve with proper hoseline placement and ventilation. If suppression activities are taking place and the conditions are getting worse, it could be an indication of a more serious undetected problem.

Begin at the ceiling; look for rollover and the heat line. Next, scan the area directly in front of your feet. Look for hazards and obstacles such as stairwells, shafts, and openings in the floor. Enter the room. Put your back up against the wall and continue your scan of the room in a slow, horizontal sweep.

Starting on the wall, and in a slow, horizontal sweep, go around the room until you see the wall over your right shoulder. During your scan, note the locations of windows that could be used for ventilation and provide a secondary means of egress.

Furnishings can give clues with regard to the room's occupant. As an example, if bunk beds are present, it will indicate to the search team that it is a child's room. Look under beds and in closets, places in which a child would try and hide from fire.

In industrial areas, note dangers such as containers that may hold hazardous materials that may explode when exposed to heat. The camera is capable of detecting the amount of liquid in a container by displaying the frost line of the product.

In commercial buildings, high-rack storage might collapse when metal structural components are weakened by exposure to flames. Also, stock can absorb water from sprinklers and hoselines, and the additional water weight might cause the stock to exceed the rack's weight limit and the rack unit to collapse. Firefighters crawling on their hands and knees would be unaware of these dangers.

- Use extreme caution when scanning the area of activated sprinkler heads. Cold water dispersing from an open sprinkler in a heated atmosphere head will appear as a shower of black rain on the camera screen. Infrared energy cannot penetrate the water droplets. Victims and hazards covered by the water spray become obscure and difficult to recognize.
- Look for obstacles, such as a partial ceiling collapse, that could entangle members during their search or hinder the advancement of hoselines. Make these conditions known to the members so they can avoid the dangers.
- Note the location of other doors and rooms that may hide victims.
- Look for construction features, such as truss construction and open stairwells, that are prone to collapse or can cause rapid fire spread. Immediately notify the incident commander (IC) of these features or signs of collapse.
- Reposition the camera so that it provides a line of sight behind furniture and obstacles. A limitation of the TIC is that it cannot penetrate construction material or furniture. These items could hide a fire victim. Look at the position and progress of your firefighters. Keep members in sight, and assist them as necessary. Follow a set procedure not to overlook any areas.



## SEARCHING METHOD

I have observed that many departments use the TIC in the following manner when searching. The cameraman positions himself at the door of the room that is about to be searched. The firefighter observes dangers and conditions and then relays this information to the other search team members. The members then proceed to search. One firefighter goes along the right wall, the other goes along the left wall. The cameraman remains at the door giving directions. Tests have shown this method to be slow and ineffective. Search team members can't see and are forced to move slowly in zero visibility.



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A safer, more effective method is to have all search team members stay together. The approach is safer in that no firefighter is left alone. Also, the search progresses much faster, and more area can be covered in a shorter time. If a person is found, all are together and can assist in the removal. It is also easier to alert search team members of dangers and to expedite their escape. Search team members experience less stress and fatigue. The cameraman leads the way. All members of the search team must remain in contact with the cameraman.

After the initial scan, enter the room along the wall. Maintaining contact with the wall provides a margin of safety in that if the camera fails, firefighters can turn around and follow the wall back to the doorway. If windows are along the wall, ventilate as you proceed. Also note their locations for the purpose of secondary egress. If a victim is sighted, the entire search team should remove him. The cameraman should lead the entire team to the victim and then to the exit.



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Note that the camera cannot see through furniture. Therefore, the cameraman must reposition himself to obtain a straight line of sight to view victims sitting on or lying behind furniture (see photo 1). Photo 2 shows a victim lying on the floor. This photo was taken during a training drill; there was no heat in the room. The body appears to be white. However, if the ambient temperature of the room were greater (fire conditions), the victim outline would appear darker in color. Reflections can "fool" the camera. Glass, plastic, furniture, and even a painted wall can pick up the reflection of a victim and lead the search team to the wrong location (see photo 3).

Have a set plan in case the TIC malfunctions. Should this happen, stop immediately and report the incident. Decide if it is safe to continue the search using standard department practices. Take into account the amount of air remaining in your SCBA and that your escape time will now be longer without the aid of the thermal



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imaging camera. Members should make their position known to the IC and work as a team. They should stay together, crawl for the wall, and follow it around until they reach an exit. (Remember, always identify a secondary means of egress. Having the TIC does not mean you can freelance. You must still follow your department's standard operational procedures for search and rescue.



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Keep track of the camera's position at all times. The IC must know the unit's identification and the area in which it is operating.

Establish a procedure for making the TIC available to the FAST team if it is needed. The camera operator should have a portable radio so he can be notified immediately if the camera is needed for an operation involving the rescue of a downed or lost firefighter.

## HAZARDOUS-MATERIALS INCIDENTS

The TIC has not been proven to be intrinsically safe. Consequently, if you must use the camera in a possibly explosive atmosphere, turn on the camera outside the danger zone. The camera should be fully operational, not in the standby mode. Cautiously approach the area upwind, and scan for the hazardous conditions. Once the dangers have been identified, withdraw the camera. Do not shut it off or place it in the standby mode until you and the camera are out of the danger zone.



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## OPERATING TIPS

Following are a few tips for operating and maintaining the thermal imaging camera.

- Always carry a replacement battery. Attach a small pouch directly to the camera strap to hold the spare. This will extend operational time without having to return to the apparatus for another power supply. All batteries should be labeled or marked numerically or alphabetically or by color coding to eliminate confusion when changing the battery or charging it (photo 4).
- Place a piece of duct tape on the side of the battery. Place a small fold at the top of the tape to create a handle (photo 5). This will make removing the battery faster and easier and will also keep the battery's electrical contact points free of dirt and moisture.
- When changing the battery under fireground conditions, tilt the camera lens up before removing the battery. This will prevent dripping water and debris from dropping into the battery compartment (photo 6).
- Attach a piece of cloth to the "D" ring of the camera handle (photo 7). This will allow you to wipe soot and moisture from the lens and viewing screen.
- During tests, it was discovered that radio signals could interfere with the TIC. The keying of the portable radio caused the camera screen to go blank. To avoid any mishaps, test your radios and cameras prior to use.



The TIC is a sophisticated piece of electronic equipment, built to withstand extreme fireground conditions. Although these tools have proven to be rugged and reliable, they must be properly maintained. In addition to ensuring a power supply, clean the lens and LCD screen to facilitate viewing of the image.

You must train in using the TIC under all conditions. Only then will you be able to recognize and interpret the images. All members must comply with their department's standard operating procedures for safety. The camera can create a false sense of security. Even when the TIC is in use, you must use proper judgment with regard to the safety of all

operating personnel. Train to survive.

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