Thermal Imaging Camera Intrinsic Safety

Public Employee Alert #14
Safety Bulletin
ATTENTION: Fire Service Managers
April 2001

This notice is being sent as a ***WARNING*** that the **THERMAL IMAGING CAMERAS** currently being used by the fire service in New Jersey have not been certified to be INTRINSICALLY SAFE.

OSHA Standard 29 CFR 1926.449 defines
Intrinsically Safe Equipment and Associated Wiring **as :**

Equipment and associated wiring in which any spark or thermal effect, produced either normally or in specified fault conditions, is incapable under certain prescribed test conditions of causing ignition of a mixture of flammable or combustible material in the air in its most easily ignitable concentration.

Using a **THERMAL IMAGING CAMERA** at hazardous material incidents where flammable and explosive atmospheres exist may be extremely dangerous.

The manufacturers operating instructions should be followed in conjunction with the New Jersey Division of Fire Safety Standard Operating Procedures 100.01-2000, Thermal Imaging Camera Use (See Attached SOP).

Before using the **THERMAL IMAGING CAMERAS** at fire or hazmat incidents be sure that the batteries are fully charged and ready for use. If batteries need to be changed while the camera is in use, you must exit the Hot Zone or Fire Area to change the batteries. Make sure the camera is turned on before entering the Fire Area or Hot Zone and turn the camera off only after you have exited the Fire Area or Hot Zone.

For Additional Information on Public Employee Safety and Health Contact:

Safety Issues, Recordkeeping and Discrimination Complaints
New Jersey Department of Labor
PEOSH Program
PO Box 386
Trenton, NJ 08625-0386
609-292-0767
800-624-1644

Protecting NJ Public Employees
PEOSH

Health Issues
New Jersey Department of Health and Senior Services
PEOSH Program
PO Box 360
Trenton, NJ 08625-0360
609-984-1863

PURPOSE:

This procedure is designed to establish guidelines to facilitate the most effective method for deploying the Bullard thermal image camera in a way that provides the most protection for fire department personnel and to provide a reference document to be used for training of personnel in the uses, deployment, limitations, operation, and care and maintenance of the Thermal Image Camera (TIC).

SCOPE:

All fire department personnel.

RESPONSIBILITY:

All officers and fire department personnel.

SAFETY:

Use of a TIC during emergency operations will provide the means for locating victims and fire in a more expeditious manager. This will greatly enhance the safety of personnel by limiting time spent in the hazardous area searching for victims and the seat of fire. It must be remembered that a TIC is a tool to be utilized by firefighters and will be used to augment sound strategy, tactics and time tested interior structural firefighting and rescue procedures.

PROCEDURE:

Training

A training video is included with each TIC. Before the TIC is placed in service, all personnel expected to use the camera should view the training video. Additionally, the manufacturer is providing training either directly to fire departments or regionally and it is strongly recommended that select department staff, who in turn can train the rest of the department attend.

Thermal Image Camera Uses:

A. Provides safer navigation in a space where there is diminished visibility due to smoke.

B. Allows personnel to "see" in a diminished visibility environment, which is a very useful addition to traditional search and rescue techniques. Utilizing a TIC can substantially reduce the time necessary for completing a primary search.

C. Enables suppression crews to execute a faster, more effective interior attack. The shortest route to the fire, holes in the floor and obstacles in the structure can be determined and located efficiently.

D. Reduces fatigue of interior crews because efficiency in performing searches and suppression is increased.

E. Allows Rapid Intervention Teams to quickly and efficiently locate downed firefighters.

F. May be used to determine fluid level within a container, which may be useful during an incident involving a hazardous material.

G. May be used as a search tool to locate lost persons in open wilderness areas.

Background Information

A. Products of combustion, primarily smoke, cause of lack of visibility on the fire ground. Smoke is composed of two elements; fire gases produced by the fuel's chemical breakdown and soot. Heavy smoke causes light to be scattered or blocked since the light waves cannot penetrate the particles. This zero visibility condition is what limits the effectiveness of lighting for interior firefighting operations. This lack of visibility heightens the potential for firefighters to become disoriented and lost within the fire building and in turn could hamper their ability to exit the structure in an emergency situation.

B. Thermal energy is not visible to the human eye, but the firefighter can feel the heat present. The TIC allows a thermal heat view of one's surroundings.

C. A TIC is a device that translates a thermal picture into an electrical picture and then a visual image for the human eye. This is accomplished because it relies on the thermal energy emitted by all objects and not on reflected visible light. TICs provide vision capability with zero light present. Thermal energy is characterized by its long wavelength, and fortunately for firefighters, the nature of this long wave thermal energy allows it to travel through smoke and mist. In essence the TIC "sees" through smoke and mist.

D. Everything viewed through the TICs lens retains it shape, people look like people and rooms look like rooms. The TIC provides the firefighter with a black and white television view through the smoke and darkness.

E. When viewing a room using the TIC, hot things appear white, hotter objects appear brighter white, and colder items appear black to gray. The whiter the representation displayed, the more heat present in the object.

Limitations

A. The TIC allows a two dimensional view of a smoke filled environment. Depth perception is limited. Firefighters operating the camera should remain low to the ground, scanning the entire area before them. When scanning an area with the TIC, begin at the ceiling and conclude at the floor area immediately in front of them. Walking with the TIC is discouraged as trip hazards may be overlooked.

B. Thermal energy does not travel directly through walls. A TIC does not allow an area to be viewed that is behind a wall. If fire is present inside a wall, the camera will only be able to "see" if the fire has increased the temperature of the wall itself. Fire inside wooden clad walls will be picked up much faster than fire on the other side of a more significant barrier such as concrete. Normal overhaul procedures must be utilized in order to locate fire extension.

C. A human being will not provide sufficient thermal energy to penetrate most standard construction materials or solid items such as furniture. Therefore, it is reinforced that while conducting a search, rescuers must look under and around beds, sofas and other objects and in closets where victims may have hidden to escape fire.

D. Water, plastic and glass are all effective barriers for the TIC and may cause a reflective image. The team operating the camera must remember that the image present on the TICs screen could be a "mirror image" of themselves or fire behind them being reflected off of glass, plastic or water. To test suspicious images, the crew should wave their arms and determine whether they are seeing their own image.

E. Also, firefighters and occupants, who are wet from hose line operations, could be masked from the camera's view during a search because there is a momentary balance of thermal signatures.

F. The TIC must be used with the understanding that it is only a mechanical device and it can fail. Firefighters must plan for this possibility by carrying flashlights, maintaining contact with the wall, a hose line, employing a tag line or other routine methods for remaining oriented to location and the position of exits in a diminished visibility environment. Crews should continue to employ standard fighting practices.

G. Be aware that if the controls on the TIC are bumped the unit could become deactivated.

H. The image displayed by the TIC may decrease in quality as soot builds up on the lens and screen while operating on the fire ground. A soft cloth or a gloved hand should be used to clean the lens and screen periodically while operating the camera.

I. If the picture displayed on the screen suddenly becomes distorted or dark:

   a. Check to insure the carrying strap is not in front of the lens;

   b. Make sure the "thermal throttle" is not shut.

J. The Thermal Imaging Camera has not been determined to be intrinsically safe as an ignition source. This device is not to be used in a potentially explosive atmosphere.

General Operation of the TIC

A. The TIC is stored in a plastic, waterproof case. The camera, including its carrying strap, and accessories must be completely dry before returning them to the case so moisture is not trapped inside.

B. Included in the storage case are the following: TIC, Carrying strap, Spare battery and a battery charger.

C. In order to deploy the camera, remove it from the case and firmly grasp the pistol grip handle. The shoulder strap should be utilized in order to lessen the chance of the unit being dropped.

D. To turn the unit on, push the large GREEN button on the left side of the unit. It will take approximately 15 - 30 seconds for the unit to warm up, self check and become operational.

E. Once the camera is active, an image will be visible on the screen. Cool areas appear dark while sources of heat appear white.

F. On the LEFT side of the display screen, 5 LEDs allow the operator to see the amount of energy reserve that remains in the units battery pack.

G. Forward of the GREEN power button and adjacent to the lens is a black, notched wheel. This is similar to the contrast control on a camera. By manipulating this knob clockwise (as one looks at the screen), the differentiation between cool and hot areas will become crisper. However, this also results in less of a spectrum of black to gray to white that will be created of cool to warm and warm to hot areas. The knob's range of adjustment is one revolution. Bullard refers to this wheel as the "Thermal Throttle."

If the camera is not to be used for a period of time but needs to remain in a state of readiness, press the YELLOW "sleep" button located next to the GREEN power button. By using the "sleep" feature, battery life is extended. When the camera is in the "sleep" mode the screen will be blank, however, the battery power LEDs

H. will remain active and a "sleep" symbol will appear on the screen. To activate the camera from the "sleep" mode, depress the YELLOW button.

I. If the battery power LEDs indicate that the battery has less than 1/4 of its energy capacity remaining, it should be replaced with a fully charged battery. If the camera is deployed on an incident, the battery should always be replaced with a fully charged battery at the conclusion of the incident to insure that the camera is always in a constant state of readiness. The camera's battery is located in a compartment directly below the viewing screen. To remove the battery, flip up the two black tabs and open the hinged door. Ensure that the replacement battery is reinserted with the same orientation so that the battery's contact points coincide with those of the camera. Two batteries are supplied with each imager, and are marked with the same number as that of the camera. These are the only batteries to be used in the TICs. Batteries can be recharged using the supplied battery charger, which has the ability of being powered from a 12-volt cigarette lighter outlet, or any other charger that accepts Motorola MT 1000 series Handi-Talkie batteries. Unlike the Handi-Talkie chargers on the apparatus, which require 16 hours to charge a depleted battery, the chargers supplied with the TICs are rapid chargers, which can recharge batteries in less than one hour.

Incident Operation of the TIC

A. Personnel should become familiar with the location of the TIC on the apparatus. The company officer shall determine who will operate the TIC.

B. If conditions warrant the use of the camera, the TIC operator should be directly behind the nozzle operator or should lead a team where hose lines are not required to be deployed. The most efficient operation of the camera occurs when its operator's view is not obstructed by other firefighters. Camera operators must be aware that they have a tendency to move faster than the rest of the team who are operating in zero visibility. Search and suppression activities should occur in compliance with their respective S.O.P.s and standard firefighting practices should be observed with the TIC acting as an "extension of the hand." Two person teams at a minimum are to be deployed at all times.

C. In moderate to heavy smoke conditions the Camera allows a crew to quickly check a smoke filled area to determine whether or not there is fire present. The camera operator must remember not to move too quickly, so that the rest of the team is not lost in the reduced visibility environment.

D. The Camera has the potential to inspire overconfidence because it allows firefighters to "see" in an environment that in reality has zero visibility. Firefighters should remember that they must stay low even if the camera allows them to see that the majority of the heat is at the ceiling. The possibility of a flashover in the dynamic atmosphere of a structure fire is higher than ever before because of new materials, construction methods and rapid responses. Personnel must understand that the camera could fail and an escape route must be easily located, either by following a hose line or rope tag line to safety.

E. It is important for firefighters to allow sufficient time to exit a hazardous atmosphere when the battery status indicator shows that the battery power is getting low.

F. The camera can also serve as a tool for detecting heat during the overhaul phase of an incident. It must be remembered, however, that the TIC cannot penetrate most construction materials including drywall, plaster and lathe, concrete, glass or plastic. Also, the TIC cannot penetrate water. Because the camera has a black and white display it is sometimes difficult to differentiate between what is heat or fire trapped in a wall and what is radiant heat.

Inspection Procedures

A. The camera should be checked as part of the (daily - weekly - change of tour) equipment check or the apparatus to which it is assigned.

B. The camera should be inspected for cleanliness. If any part of the camera is dirty a clean rag dampened with soapy water should be used to clean the camera. No harsh detergents or solvents should be used. To clean accumulated soot from the lens a soft cloth and alcohol should be used.

C. The camera and its carrying strap must be thoroughly dry before being returned to the airtight case.

D. The camera should be turned on and checked for proper operation and then turned off.

E. If the battery charge indicator displays more than one bar of discharge the spare battery should be placed in the unit and the discharged battery charged with the provided charging unit.

F. The camera should be returned to its case and all latches secured.

G. Problems with the unit should be reported to the OIC and a defective equipment form filled out.

Maintenance

A. Batteries should be rotated weekly and charged as necessary on a set day (i.e. Fridays).

B. Screws on the camera should be checked periodically for tightness.

C. After the camera is used on an incident it should be thoroughly cleaned and dried before it is returned to its airtight case and the camera's battery, along with the spare, should be fully charged.