ELEMENTS NEEDED FOR A FIRE SERVICE THERMAL IMAGING CAMERA TRAINING PROGRAM

EXECUTIVE DEVELOPMENT

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An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

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Abstract

Port Orange Fire & Rescue purchased two thermal imaging cameras, and after an initial orientation with the cameras put them in service. The problem was that the Port Orange Department of Fire & Rescue (P.O.F. & R.) had no formal employee training program for their thermal imaging cameras (TICs). The purpose of this applied research project was to identify elements needed for a formal TIC training program for the employees of P.O.F. & R.

A descriptive research methodology was used to make a detailed observation, in order to identify what elements were needed in a formal TIC training program for the employees of P.O.F. & R. A descriptive methodology was employed to answer the following four questions:

1. What were the federal or state guidelines that addressed the issues of thermal imaging training?

2. What were the strengths and limitations of a TIC, and how can those strengths and limitations be clearly demonstrated in the training environment?

3. What types of training elements were recommended by thermal imagining manufacturers?

4. How did other fire departments, operating with thermal imaging cameras, conduct their TIC training?

The procedures utilized to obtain the data presented in this research project came from three mediums. They were print, an interview, and a feedback form.

The major results of this research were that although there are no federal or state guidelines on thermal imaging training, the strengths and limitations of thermal imaging cameras were well documented. Those strengths and limitations could be clearly and safely demonstrated in a creative learning environment.

Recommendations were that P. O.F.& R. use the strengths and limitations of TICs and develop them into elements of a formal training program that can be clearly and safely demonstrated in the training environment.

Table of Contents

List of Figures

Introduction

In September of 1998, the City of Port Orange, Florida purchased a Cairns Thermal Imaging Camera in a helmet mount. At that time, six line employees were given a four-hour course in the classroom and in our burn building on how to use this camera. A Cairns Company representative gave this course. In February of 2002, the City purchased a handheld thermal imager by Scott Manufacturing. There was no training given by the distributor or company. Since 1998, the only training on this equipment has been in-house training with no outlines or guidelines.

The problem is that the Port Orange Department of Fire & Rescue (P.O.F. & R.) has no formal employee training program for their thermal imaging cameras (TICs). The purpose of this applied research project is to identify elements needed for a formal TIC training program for the employees of P.O.F. & R.

This was a descriptive research project. The researcher utilized the descriptive research methodology to make a detailed observation, in order to identify what elements are needed in a formal TIC training program for the employees of P.O.F. & R. Descriptive research was employed to answer the following four questions:

1. What are the federal or state guidelines that address the issues of thermal imaging training?

2. What are the strengths and limitations of a TIC, and how can those strengths and limitations be clearly demonstrated in the training environment?

3. What types of training elements are recommended by thermal imagining manufacturers?

4. How do other fire departments, operating with thermal imaging cameras, conduct their TIC training?

Background and Significance

Thermal imaging technology and the application of this equipment in today's fire service is in the beginning stages. Although the technology has been in use for several decades, the application for the fire service has only been available since the mid 1990's. The technology for application in the fire service has now become reasonably available and is in limited use (Rowley, 2000).

Before P.O.F. & R. started using thermal imaging technology, our formal training revolved around common, recognized, industry standard methods for strategy and tactics on emergency scenes. Now that we are utilizing this new tool, our formal training needs to encompass the strengths and limitations of TIC. In the future, P.O.F. & R. needs to have this technology recognized in both formalized training outlines and in applicable Department Standard Operation Guidelines (SOGs).

This research project relates to the United States Fire Administration's operational objective, "Reduce the loss of life from fire of firefighters" (NFA, 2002), by identifying the elements needed for a formal TIC training program for the members of P.O.F.& R. This training will point out strengths and limitations in thermal imaging technology that will assist our firefighters in their tactical objectives, while keeping firefighter safety a priority.

This research study is related to the Executive Development Class through the areas of study involving service quality, by identifying the elements needed for a formal TIC training program for the members of P.O.F.& R. (NFA, 2002).

Literature Review

The literature review was performed to identify strengths and limitations of TICs and any elements needed in a formal TIC training program. Also, to review any federal or state guidelines that address thermal imaging technology and training issues. The literature review involved a search of trade journals, textbooks, Fire Department training programs, operating and maintenance manuals, the Internet, state and federal regulations, interviews, a feedback form, and published Executive Fire Officer Applied Research Projects (EFO ARP).

Research question one addressed the issue of any federal and state guidelines that were concerned with thermal imaging training. The Florida State Statues, National Fire Protection Association Codes and Standards, including 1720, Occupational Health and Safety Association, State of Florida Fire College, and the State of Florida Fire Prevention Codes were reviewed. No information concerning this area of research was discovered. Mike Richardson and Rebecca Scholer stated, "While most other fire service training can follow standards or official references established by the National Fire Protection Association, or another national organization, this is not yet the case for thermal imaging" (p. 87).

Research question two concerned the strengths and limitations of a TIC and how those strengths and limitations can be clearly demonstrated in the training environment. Michael T. Richardson discussed in the December 2001 *Fire Chief* how an incident commander, or company officer, can use a TIC to find the seat of the fire, observe fire progress and spread, identify critical building construction features, and monitor threats to structural integrity. The article, "Image is Everything," in the May 1998 *Fire Rescue Magazine,* identifies 12 areas that display the strengths of TICs. This includes response, size-up, attack, search extension,

command in the sky, hazardous materials, water rescues, rapid intervention teams (RIT), wildland fires, overhaul, and mutual aid.

Richardson (2001) also points out some of the limitations of a TIC, such as the inability to look into glass or Plexiglas. In the October 2000 *Firehouse,* Rick Crickenberger and Ben Sojka explain that limitations such as limited battery life, depth perception problems, and the fact that a TIC can malfunction at any given time must be stressed to firefighters. The Scott® Operations Manual states this warning:

> Never become wholly dependent on the Eagle Imager Thermal Camera for personal navigation. It is not a night vision camera. Always maintain awareness of location and escape routes when using this device. Failure to do so may result in personal injury or death. (p. 2)

Other issues discussed are that firefighters may speed up the search process, causing them to get deeper into buildings. This may become a problem due to a limited air supply. Firefighters also have a natural desire to stand because they can now see. This goes against the fundamentals of staying low below superheated smoke and gases. Firefighters can also become too dependent on the device and in time of failure become totally disoriented. Untrained users may also misinterpret the TIC data, such as holes in the floor or reflections of thermal signatures off of polished surfaces.

M. T. Richardson and R. Scholer (2001) explained how these strengths and limitations could be demonstrated in a training environment:

> Many departments are taking an approach to thermal imaging training that is similar to the approach used by hazardous materials responder. An "Awareness" or "Operations" class is conducted for first-time users, concentrating on the operating procedures for the

> unit and the basics of thermal imaging, with an introduction to applications. A "Technician" class ensures that firefighters have a thorough understanding of thermal imaging, the unit that is being used and applications for the technology. Finally, a "specialist" class concentrates on advanced applications of thermal imaging with a high emphasis on hands-on training. (p. 87)

The key elements that they hit on include reinforcing basic principles, learning to interpret images, modifying the behavior of the firefighter, mutual aid units, and incorporation into SOGs. Richardson and Scholer also give alternatives to live fire training by utilizing dark rooms and smoke machines to reduce visibility and using space heaters or gas burners to simulate heat sources.

Research question three considered the types of training elements that thermal imagining manufacturers recommended. A review of operation manuals from both Cairns IRIS® and a Scott Eagle® revealed that the manufacturers explain about the care, maintenance and operation of TICs. They also can illustrate the strengths and limitations of TICs, while suggesting hands on training. The Scott Eagle® operating and maintenance instructions state, "Use and maintenance of this instrument must be part of a complete emergency rescue training program. The following procedures shall be used to operate and maintain the unit prepared for emergency use" (p. 2). Tim McDonald, a distributor for ISI Navigators® and Survivals®, stated in a phone interview that it is not uncommon for manufacturers to suggest private industry training companies such as SAFE-IR to departments purchasing TICs. Mr. McDonald said he sometimes would include the cost of this training into bid requests.

Research question four asked how other fire departments, operating with thermal imaging cameras, conduct their TIC training. It is astounding how many fire departments have put a TIC into service with little or no training (Woodworth, 2000).

Cook (2000) states, "The TIC is just a tool, and you have to apply standard training and tactics to ensure continued safe operations in the event a failure occurs. Lack of adequate personnel training can render a TIC useless" (p.32). Cook went on to explain that fire departments, such as the Granbury Volunteer Fire Department in Texas, conduct search and rescue drills at buildings within their district after closing. The drill is conducted in the dark, victims are hidden, firefighters use the oriented search to located victims, and the TIC is taken away at some point during the training to see if the crews act accordingly.

According to statistics gathered by this researcher in a feedback form (Appendix A), of the 25 departments that own a TIC, an astounding 11(44%) do no yearly training at all. Only 3(12%) train on the unit three or more times a year and no more than 5(20%) have a written training procedure.

Training that is being done occurs when the unit is first purchased and when new employees are hired. Training can involve both psychomotor and didactic in-house training. One department stated that whenever search and rescue drills are performed, a TIC is used. Fire department training programs include the review of TIC technology, maintenance, and if they have any, a review of department SOGs. Of the 25 departments that own a TIC, 6(24%) have a SOG that addresses TICs. Appendix D is a copy of the Tamarac Fire Rescue Department's Operational Guidelines for Thermal Imaging Devices. Field training is done in conditions that closely resemble applicable environments.

In summary, the literature review has shown that a formalized training program needs to be established, to improve service quality and to increase firefighter safety. The strengths and limitations of thermal imaging can be researched and applied realistically and safely to the training environment.

Procedures

Descriptive research methodology was used to determine and report the present status of TIC training in other Florida fire departments in order to identify the elements needed for a formal TIC training program for the employees of P.O.F. & R.

The procedures utilized to obtain the data presented in this ARP came from three mediums. They are print, an interview, and a feedback form.

A majority of the data referenced in this ARP was acquired from fire industry trade journals and other NFA ARPs obtained from the NFAs Learning Resource Center, located in Emmitsburg, Maryland. Periodicals, books, trade journals and applied research projects were researched for any pertinent information. Additional research in the area of federal and state information was conducted from the P.O.F. & R. Fire Inspection library and the Training Division library. An Internet search was conducted to locate educators, manufacturers, distributors, and other information on thermal imaging technology training.

An interview was conducted by phone on October 24, 2002, with Tim McDonald. Mr. McDonald is a distributor for ISI Navigators® and Survivals® and has worked in the industry for several years. The interview questions asked are located in Appendix C.

A feedback form (Appendix A) was needed to obtain the following information relating to TICs and training: (a) Does your department currently use a TIC, (b) Is the use of your TIC addressed in your SOGs, (c) Do you have a formalized annual training program for your TIC,

(d) How many times annually does formalized thermal imaging training occur, and (e) What have you found to be the strengths and limitations of your TIC? Suzy Thomas, assistant for the Florida Fire Chiefs' Association (FFCA), distributed the feedback form. The form was sent via e-mail to the population of all Florida fire chiefs, who are members of the FFCA, from the Associations web site at www.ffca.org. Of the 302 surveys sent out 37 where returned by mail and e-mail. Appendix B shows the compiled data from the feedback form.

Limitations and Assumptions

An assumption made at the beginning of the research project was that there would be federal and state guidelines regarding TICs. The literature review indicated that this assumption was not correct. The limitations that affected this research project included the lack of federal and state guidelines addressing the training issues of TICs. More limitations included the fact that this technology is relatively new and in limited use in the fire industry and there is a narrow availability of reference materials concerning the training aspects of TICs. This project also had a predetermined time limit.

Of the 302 feedback forms distributed by the FFCA, 37 were returned. Suzy Thomas stated that this low number is common due to indifference of individuals with surveys that are of no interest to them and individuals who do not monitor their e-mail. Other reasons may be that fire departments who do not own a TIC did not feel in was necessary to respond, or that the recipient did not receive the survey. The sample was restricted to only Florida fire departments that are members of the FFCA.

It is assumed the respondents to the feedback form answered honestly and that if the feedback form was sent to more fire departments from around the country a more balanced result would be established.

Definition of Terms

Didactic. Concerning instruction by lectures and use of texts as opposed to clinical teaching. (Taber's Cyclopedic Medical Dictionary, 1997).

Incident Commander. The person responsible for directing and controlling operations at an emergency incident (International Fire Service Training Association, 1998).

Mutual Aid. An agreement between communities to provide firefighting resources when needed (International Fire Service Training Association, 1998).

Overhaul. The process of searching for and extinguishing hidden or remaining fires (International Fire Service Training Association, 1998).

Psychomotor. Concerning or causing physical activity associated with mental processes (Taber's Cyclopedic Medical Dictionary, 1997).

Rapid Intervention Teams (RIT). A team of firefighters used for the rescue of other firefighters at an emergency incident (International Fire Service Training Association, 1998).

Size up. The ongoing process of identifying and evaluating the conditions of an emergency incident (International Fire Service Training Association, 1998).

Standard Operating Guideline (SOG). A predetermined plan that provides a standard set of actions (International Fire Service Training Association, 1998).

Thermal Imaging Camera (TIC). A heat sensitive device that displays heat pictures (McLaughlin, 1992).

Thermal signatures. The impression that is still visible through the TIC after a person touches an object or gets up from a piece of furniture (Theriault, 2000).

Results

The literature review has shown that there are no federal or state guidelines that address the issues of thermal imaging training. Without firm and established guidelines, department officials may find it challenging to determine the best approach (Richardson, 2001). This was an unexpected finding, but does demonstrate that thermal imaging is a relatively new field of study in the fire industry.

Question two asks about the strengths and limitations of a TIC and how they may be demonstrated in the training environment. Michael T. Richardson discussed in the December 2001 *Fire Chief* how an incident commander or company officer can use a TIC to find the seat of the fire, observe fire progress and spread, identify critical building construction features, and monitor threats to structural integrity. The article, "Image is Everything," in the May 1998 *Fire Rescue Magazine* identifies 12 areas that display the strengths of TICs. This includes response, size-up, attack, search extension, command in the sky, hazardous materials, water rescues, rapid intervention teams (RIT), wildland fires, overhaul, and mutual aid.

The fifth question in the feedback form asked, "What have you found to be the strengths and limitations of your thermal imaging technology?" Some of the repeated responses associated to strengths in the question are as follows: finds hot spots, helps RIT teams, aids in search and rescue, it is light weight, it has a video overlay and can transmit victim location at night or in bad weather conditions, and helps reduce the damage during overhaul.

Limitations of a TIC include the inability to look into glass or Plexiglas. Other documented limitations are limited battery life, depth perception problems, and the fact that a TIC can malfunction at any given time. Additional problems are that firefighters may speed up the search process, causing them to go further into a hazardous environment. Firefighters also

have a natural desire to stand because they can now see. This goes against the fundamentals of staying low below superheated smoke and gases. Firefighters can also become too dependent on the device and in time of failure become totally disoriented. Untrained users may also misinterpret the TIC data, such as holes in the floor or reflections of thermal signatures off of polished surfaces (Crickenberger 2000).

The strengths and limitations are the basic elements that should make up a formal TIC training program. These elements can be demonstrated in the didactic training environment by reviewing documented TIC literature, manuals, and related department SOGs. Creative training methods can demonstrate the psychomotor elements. These can include the use of existing training facilities, which offer smoke and heat conditions; structures sighted for demolition; or any other area building that is blacked out. Live victims can be used, as well as simulated heat signatures such as hot water bottles or small heating elements. The TIC training also needs to include other use factors, such as locating a victim outside of a structure, haz-mat training, water rescue, RIT, and interpretation of heat signatures. All training should point out and modify any unwanted behavioral changes such as the desire to stand, a dependence on the TIC, a disregard for traditional methods of search or firefighter safety, and disorientation when the TIC is turned off to simulate breakdown of the unit.

The third question addresses the manufacturer's recommendations. The manufacturers will review care and maintenance procedures. Some manufactures and distributors also offer a limited amount of training, when first purchasing TICs. Others may suggest private industry training companies, or even build that element into the bid package.

An interview was conducted by phone on October 24, 2002 with Tim McDonald. Mr. McDonald is a distributor for ISI Navigators® and Survivals® TICs, and has worked in the

industry for several years. He stated that it is not uncommon for manufacturer's to suggest private industry training companies such as SAFE-IR, to departments purchasing TICs. Mr. McDonald said that he sometimes includes the cost of this training into bid requests. The interview questions asked are located in Appendix C.

Question four addresses how other fire departments conduct their TIC training. A feedback form obtained this information.

The first question on the feedback form asked, "Does your department currently use a thermal imaging camera (TIC)? Of the 37 responses returned, 25(78%) answered yes and 7(22%) answered no. Anyone who answered no was advised that the form was completed.

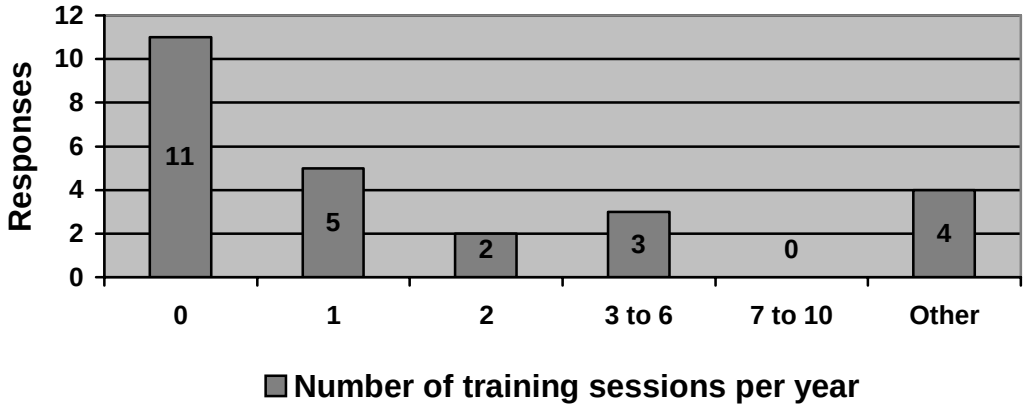
The second question on the feedback form asked, "Is the use of your TIC addressed in your standard operating procedures or guidelines?" Of the 25 responses, 6(24%) answered yes and 19(76%) answered no.

The third question of the feedback form asked, "Do you have a formalized annual training program for your TIC?" Of the 25 responses, 5(20%) answered yes and 20(80%) answered no.

Question four of the feedback form asked, "How many times annually does formalized TIC training occur?" Of the 25 responses, 11(44%) answered none, 5(20%) answered one, 2(8%) answered two, 3(12%) answered three to six, no one picked seven to ten and 4(16%) picked other (see Figure 1).

Figure 1

How many times annually does formalized thermal imaging training occur?



The four responses to *other* filled in the following: one wrote that new hires received TIC orientation, another wrote that whenever search and rescue is practiced the TIC was used, and two responded that they only had training when the unit was first put in-service. Appendix B has the feedback form with all calculations.

Discussion

The examined literature revealed that there are no federal or state guidelines that address thermal imaging training. This is one of the fastest growing technologies in the fire industry. Rick Crickenberger and Ben Sojka explain, in their article in the October 2000 *Firehouse*, the growth of TICs:

> Thermal imaging cameras will have a monumental affect on the way the fire service does business. A combination of lower prices, more competition, better performing equipment, higher visibility, better education and new funding sources are driving the thermal imaging market into high gear. In 1999, an estimated 7,500 thermal imaging cameras were being used in U.S. fire departments. Growth of the thermal

> imaging camera market is projected to exceed 100,000 units in the next several years. (p. 66)

With no federal guidelines to review or use as a standard, most fire departments are not using any training guidelines or they are making up their own. As stated by Mike Richardson and Rebecca Scholer, "While most other fire service training can follow standards or official references established by the National Fire Protection Association or another national organization, this is not yet the case for thermal imaging. Without firm and established guidelines, department officials may find it challenging to determine the best approach." (Richardson, 2001)

The strengths of TICs have clearly been documented. The article, "Image is Everything," in the May 1998 *Fire Rescue Magazine,* identifies 12 areas that display the strengths of TICs. These include response, size-up, attack, search extension, command in the sky, hazardous materials, water rescues, rapid intervention teams (RIT), wildland fires, overhaul, and mutual aid. Michael T. Richardson discussed, in the December 2001 *Fire Chief,* how an incident commander or company officer can use a TIC to find the seat of the fire, observe fire progress and spread, identify critical building construction features, and monitor threats to structural integrity.

Limitations of TICs in the field include the inability to look into glass or Plexiglas, limited battery life, depth perception problems, and the fact that a TIC can malfunction at any given time. Other limitation issues discussed by Rick Crickenberger and Ben Sojka are that firefighters may speed up the search process, causing them to get deeper into buildings. This may become a problem due to a limited air supply. Firefighters also have a natural desire to stand because they can now see. This goes against the fundamentals of staying low, below

superheated smoke and gases. Firefighters can also become too dependent on the device and in time of TIC failure become totally disoriented. Untrained users may also misinterpret the TIC data, such as holes in the floor or reflections of thermal signatures off of polished surfaces. If the TIC is not built into any department SOGs, and if confidence and training of the units are not seen as a department priority the units may not be used during on scene emergency operations.

Both limitations and strengths can be demonstrated in the educational environment with the use of creative training. The key elements need to include modifying the behavior of the firefighter, reinforcing basic principles, learning to interpret images, care and maintenance procedures, and incorporation into departments SOGs. Richardson and Scholer also give alternatives to live fire training by utilizing dark rooms and smoke machines to reduce visibility and using space heaters or gas burners to simulate heat sources.

Manufacturers recommend that some type of a training program be used. They supply operating and maintenance instructions, along with specifications and performance parameters. They can also recommend private industry training companies to assist with getting a training program instituted.

The training that other fire departments conduct ranges from no training to formal training outlines that are backed by department SOGs.

This author's interpretation of the study results is that P.O.F.& R. can utilize the elements identified in this descriptive research and incorporate these elements into a formal TIC training program.

Recommendations

Thermal imaging technology gives firefighters the gift of sight in an otherwise blind environment. This study clearly shows that training with thermal imaging technology is imperative. Mike Richardson and Rebecca Scholer state how important training can be (2001):

> For firefighters to maximize the potential of thermal imaging technology, and to do it safely, training should take place on a regular basis. Without adequate training, disastrous results are possible:
>
> - Having had their sight returned, firefighters are more likely to take actions that endanger them, including standing and walking, advancing in a structure without reference points and advancing in a structure past the "point of no return."
> - Firefighters can develop an over-dependence on the visibility that a thermal imager provides, which can prove disastrous, for example, if the unit is dropped and can't be retrieved.
> - Fire fighters may place themselves in harms way because they have misinterpreted information provided by the thermal imager. (p. 87)

When firefighters are not trained properly, use of the thermal imager may actually encourage them to take actions that will increase, rather than decrease, the risks they face on the job.

The problem now facing P.O.F. & R. is the lack of a formal employee training program for TICs. The purpose of this applied research project was to identify elements needed for a formal TIC training program for the employees of P.O.F. & R.

Recommendations will be made to P.O.F.& R., and any other fire department using TICS, needs to utilize the elements observed in this descriptive research and apply them to a

formal TIC training program. Training needs to be on-going until all members, who have accessibility to a TIC, have a comfort and confidence level that will allow them to utilize this technology safely and to its full potential.

Classroom settings need to include any information about the TIC supplied by the manufacturer. Information such as general operation of the units, day to day checkouts and maintenance, battery life and care, and internal core temperature ranges should be incorporated. Performance parameters such as sensitivity distance, internal temperature protection, and radio interference can be reviewed. How the TIC reads temperature differences (infrared radiation), and an explanation and review of interpretation of the display screen shades of gray, black, and white also needs to be covered.

Actual hands on training can be held in any building with the lights off. P.O.F.& R. has a burn building and a smoke tower that can be utilized. Live bodies, hot water bottles, heating blankets, or any other imaginative way to create a heat signature may be used. Training can be conducted in the woods, fields, water, or other environment to induce simulated real world emergency scenarios.

Areas to be covered need to include how thermal imaging can be used to find the seat of the fire, observe fire progress and spread, identify critical building construction features, and monitor threats to structural integrity. Other uses to be practiced include size-up, attack, search extension, command in the sky, hazardous materials, water rescues, rapid intervention teams (RIT), wildland fires, search and rescue, overhaul, and mutual aid.

Users need to be made aware through hands on training of any TIC limitations such as the inability to look into glass or Plexiglas, limited battery life, depth perception problems, and the fact that a TIC can malfunction at any given time. The warning that the Scott® Operations

Manual gives, “Never become wholly dependent on the Eagle Imager Thermal Camera for personal navigation. It is not a night vision camera. Always maintain awareness of location and escape routes when using this device. Failure to do so may result in personal injury or death.” (p. 2), can be demonstrated in the training environment. Any negative behaviors such as firefighters unrealistically speeding up the search process, the desire to stand, and becoming too dependent on the device need to be identified and demonstrated.

The importance of this training can be stressed to firefighters by showing them how users may misinterpret the TIC data, resulting in incomplete searches or safety issues to firefighters.

Training goals need to include the modifying of firefighter behavior, reinforcing basic principles, learning to interpret images, and the expectation of incorporation into department SOGs.

In the future, when all P.O.F. & R. firefighters have developed a proficiency with the TIC’s that mirror other firefighter tools such as air packs or forcible entry equipment, then training can move forward. Future thermal imaging technology training can concentrate on updating and honing the skills of the firefighters who use this equipment.

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Appendix A

Thermal Imaging Camera Training Program Survey
October 2002

Thank you for taking time to complete this survey. Port Orange Department of Fire & Rescue is currently developing a formal training program for their Thermal Imaging Technology and your assistance with this survey will be beneficial. The results of this survey will also be utilized by Commander Bill Whalen in an Applied Research Project required for coursework in the National Fire Academy's Executive Fire Officer Program.

Please complete the following and return by 10/31/02:

1. Does your department currently use a thermal imagining camera (TIC)?
   □ Yes □ No (If no, the survey is complete, please return by10/31/02.)

2. Is the use of your TIC addressed in your standard operating procedures or guidelines?
   □ Yes □ No

3. Do you have a formalized annual training program for your TIC(s)?
   □ No □ Yes (If yes, please send a copy via E-mail with your response.)

4. How many times annually does formalized thermal imaging training occur?
   □ None □ One time □ Two times □ Three to Six times □ Seven to Ten times
   □ Other _____

5. What have you found to be the strengths and limitations of your thermal imaging technology?

Strengths	Limitations
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Thank you for you time, if you would like a copy of the completed project please check the following box. □ Yes

Email: wwhalen@port-orange.org

Address: Commander Bill Whalen
1090 City Center Blvd.
Port Orange, FL 32129

Appendix B

Thermal Imaging Camera Training Program Survey
October 2002

1. Does your department currently use a thermal imaging camera (TIC)?
   □ Yes 25(78%) □ No 7(22%)

2. Is the use of your TIC addressed in your standard operating procedures or guidelines?
   □ Yes 6(24%) □ No 19(76%)

3. Do you have a formalized annual training program for your TIC(s)?
   □ No 19(76%) □ Yes 6(24%)

4. How many times annually does formalized thermal imaging training occur?
   □ None 11(44%) □ One time 5(20%) □ Two times 2(8%)
   □ Three to Six times 3(12%) □ Seven to Ten times 0
   □ Other "New hires receive a brief orientation."
   "Whenever we do search and rescue training we use them."
   "When we first got the unit."
   "Once when the unit first went into service."

6. What have you found to be the strengths and limitations of your thermal imaging technology?

Strengths

hands free	great addition to current tools	offers insight
visibility (6 times)	ease of one button use	hot spots (2 times)
RIT teams	transmission capabilities	video overlay
searches (5 times)	night rescues (3 times)	weight (2 times)
durable (2 times)	battery life (2 times)	Pyro-meter
reliable	reduced overhaul damage (3 times)	rapid victim rescue
heat I.D.	Over haul (6 times)	hidden fires (3 times)
boot-up time	size (3 times)	

Scans accident scene for other victims.

Limitations

heavy	difficult to use	unreliable (2 times)
cost (3 times)	battery length (2 times)	depth perception
constancy of use	awkward to wear (3 times)	hard to train

difficult to use
difference of smoke and heat
short range of transmission
no on screen temperatures
tunnel vision, misses stairs and holes

Thank you for you time, if you would like a copy of the completed project please check the following box. □ Yes 17(53%)

Appendix C

Questions asked to Tim McDonald on October 24, 2002.

1. What type of TICs do you distribute? "Both ISI Navigators® and Survivals®."
2. How long have you worked in the industry? "More years then I care to remember."
3. What types of training do you recommend? "As a distributor we don't give training or educational outlines unless it is specific for our products. Stuff like spec sheets and maintenance items. For actual hands-on training I always recommend a private company call SAFE-IR. They're made up of mostly New York City Firefighters who have extensive backgrounds with thermal imaging. The training can be expensive, I believe around two thousand dollars for a weekend class, but it's great training. I will sometimes incorporate the cost of a SAFE-IR class into my bid price if the department requests training with their unit."
4. Do you know if any other manufacturer offers training outlines for TICs? "No, not that I know of. I believe a few offer training on how to use the unit, but for actual ongoing, year after year type outlines, no I don't know of any."

Appendix D

TAMARAC FIRE RESCUE DEPARTMENT

OPERATIONAL GUIDELINES

Title:	**Thermal Imaging Devices**	**Date:**	**February 16, 2007**
		Supersedes:	**All Existing**

PURPOSE: To detail the use of the Thermal Imaging Devices during structure fires and detail the steps for maintaining the devices when they are not being used at emergency scenes.

BACKGROUND: Thermal Imaging Devices (TID'S) are designed to identify heat using infrared technology. Hot areas will present as white, or brighter areas than surrounding cooler areas when looking through the TID's viewfinder. Likewise, the cooler an object is, the darker it will present in the TID's viewfinder. *Note: All members are encouraged to read the operations manual for the Vision3 TID and the accompanying battery charger manual before attempting to use the device, or charging the batteries. All members will physically review the operation of the TID prior to using the device during emergency.

POLICY: Thermal Imagers may be used as aids in the following emergency scenarios:

1) During the Search and Rescue phase of structural fire fighting to locate victims, or downed firefighters.

CAUTION: Crews performing Search and Rescue procedures are strongly advised to use a "tag line" rope to keep the rescue group from becoming lost while searching the building, particularly if the search is deep in an involved building. Searchers may become lost if they focus solely on the TID (tunnel vision) exclusively and are not watching where they are going. The TID should never be used solely as a navigational tool. The TID should be used only with a 2-person Search and Rescue group and all safety precautions and techniques should be employed while performing this phase of fire fighting.

NOTE: It is recommended that the neck strap be attached to the TID, specifically in Search and Rescue operations, so that the searcher may utilize both hands during the rescue and the TID will not be left behind.

2) Scene size-up. Upon arrival at a structure fire, with "smoke showing", or "nothing showing", company officers may use the device to locate the seat of the fire.

3) The TID may be used to find "cool areas" such as water leaks in walls. Conversely, it may be used to locate "hot spots" within a structure, or behind obstructions, such as ballast, overheated wires, etc.

4) The TID may be used to scan the area of an accident to help locate victims thrown, or wandering away from an vehicle.

5) The TID may be used to aid in the search of people lost in heavy cover (brush, fog, fallen debris, etc)

CARE AND MAINTENANCE OF THE TID AND ITS BATTERIES

When the TID becomes soiled, it must be cleaned using a mild soap and water solution. It should be wiped off and not submerged.

BATTERY: To check the charge in the TID, turn the unit on and look at the LED in the lower left hand corner. It will shine green if fully charged. When the charge drops to 1/2 the LED will shine yellow. When the charge drops to less than 1/4, the light will shine red. It will begin to blink when there is only 5 to 15 minutes of charge left. *NOTE: The battery should not be left in an in-service imager for an extended period of time. Likewise, a battery should not be left in the charger on "trickle", nor charged again if it is already fully charged. If the primary battery and the spare battery are both adequately charged, the spare should be kept in the case with the unit and not in the charger. Periodically, the battery should be removed and replaced with the spare and a schedule should be maintained with both batteries being rotated into use.

CAUTIONS:

- Use precautions when entering a hazardous area. Finding a potential victim does not mean the area is safe to enter. All protective equipment must be worn by fire rescue personnel and safety procedures followed.

- The Vision 3 TID is not intrinsically safe. Do not use the system in environments or atmospheres where a spark, or static will cause an explosion.

- Radio transmission may cause interference with the TID.

- Do not point the TID directly at the sun. It may damage the system.

- The TID does not work reliably through glass, or when directed at water, or other reflective surfaces.