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THERMAL IMAGING FOR FIREFIGHTERS

Woodrow Matthews

This outline briefly describes the best uses of thermal imagers, their principles, theories as well as disclaims the misnomers involved with infra-red imaging.

This narrative can be preceded by a hands on live burn or simulated live situation practical course.

What is Infra-Red



(ie) Placing your hand on a wall (non reflective) after several seconds removing your hand from the wall, view the area with a TIC and notice the light color outlining placement of your hand on the wall and its position and the difference in comparison with the rest of the wall.

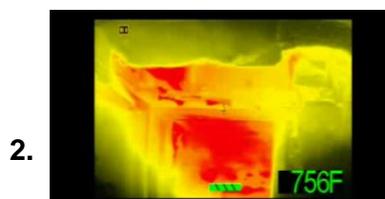
The visible eye cannot see infra-red because of its sensitivity to light.

Thermal Imagers / Infra-Red Cameras detect minute differences in the temperature of a given **surface** as displayed on the screen of the camera.

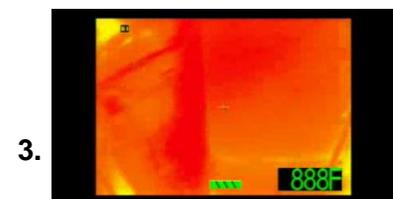
The 3 Principles of Infra-Red



Conduction: The transfer of heat through a solid object



Convection: The movement of hot air currents



Radiation: Direct sensor of temperature in highest heat detection

1. **Conduction** – This is a thermal imaging view of a roof and soffit fascia detail during live fire it shows framing and obvious hot and cold spots utilizing the principle of conduction.
2. **Convection** – The outside portions of light hazy yellow are also typical in thermal imagers that do not have colorization to show the hazy areas of difference in temperature that are moving, which are heated air currents going in the direction of ventilation.
3. **Radiation** – This depicts the hottest area in the focal plane offering evidence of the seat of the fire or areas of extension from the seat of the fire.

**** NOTE**** In Thermal Imagers that are not colorized, those areas will be brighter white in color than the other areas.



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Image Interpretation

The thermal imager simply sees differences in temperatures and displays them in a grayscale format. White is hot, black is cold and the temperatures in between are shades of gray. Ambient conditions play a role in various imaging situations.

Temperature displays are *relative* to the scene. What is “hot” in one scene may appear “cool” in another, even though its actual temperature has not changed.



A firefighter, before the fire, will generally appear as white in color because the firefighter is warmer than the background

The same firefighter during the fire may appear black in color as the firefighter is now cooler than the background



What are the dangers to be considered while using Thermal Imagers?

There is a great danger in firefighters utilizing thermal imaging to navigate full time during operation with a thermal imager.

These are electronic pieces of equipment that are intended for scanning purposes and navigational purposes only. A Firefighter using a thermal imager for anything other than what is recommended faces potentially being lost in the building by not utilizing his points of reference by left and right hand search techniques.

What do thermal imagers NOT do?

Thermal Imagers DO NOT see through walls or glass, or water.

Thermal Imagers DO NOT see smoke. They see convection.

Thermal Imagers DO NOT detect ambient temperature.

What different types of Thermal Imagers are in the Fire Service work place today and what are the differences?

160x120 pixel: very low quality image, however still offering all of the principles of thermal imaging. Anything lower than this should be considered simple navigational thermal imager, not intended for fighting fire.

320x240 pixel: which is fundamentally an advanced structural firefighting camera.

NOTE There are multi-functional thermal imagers that offer push-button options to create different effects to the image intended by the firefighter. These are not recommended for beginners.



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What are the limitations of Thermal Imagers?

Thermal imagers do not see into, through or under water by any means whatsoever.

Thermal imagers can NOT operate in extreme uninhabitable heat conditions. They do not possess super human powers and are not intended to conduct anything other than what the firefighter is capable of doing based on his training from Firefighter I class.

Firefighter Applications

1. Search and Rescue including RIT
2. Size up including vehicle placement
3. Overhaul including PPV
4. Attack Assignment including stream placement
5. HAZMAT
6. Scene Safety



Proper Safe use of Thermal Imagers

Never use a thermal imager exclusively to navigate throughout a building. Thermal Imagers are an electronic piece of equipment dependant on battery power hence to be respected as such.

All persons that are expected to use thermal imaging in their seat assignment should regularly throughout the station observe differences throughout the building with a thermal imager.

Thermal Imager Department Training

Naturally for any type of advanced training and input of uses on thermal imaging it's always best to have an in service classroom and practical training application. You can arrange this for you and your department by contacting Woody Matthews at www.MatthewsFireTraining.com

Training with Thermal Imaging using PPV techniques are also available.

www.MatthewsFireTraining.com