



## APPLICATION STORY



### See without being seen

Thermal imaging for military driver vision enhancement and increased situational awareness.

*See without being seen. This is often a major requirement for drivers of all types of military vehicles during a mission.*

*Driving with head and/or taillights turned on in hostile territory poses a serious threat for the vehicle, its driver, passengers and load since the enemy can easily monitor its activities. Still, when advancing in hostile territory, drivers need to be able to see what is ahead of them. They need to see the condition of the terrain on which they are advancing, but they also need a broad situational awareness about what is happening around them. Often it is the driver's responsibility to monitor the direct area around the vehicle for opposing forces or other threatening activity.*

*Also accidents with vehicles of friendly forces need to be avoided at all times. Not an easy task when all vehicles are driving without lights.*

But military vehicles are not only driving in hostile territory. They are sometimes operating far away from enemy lines and also when there are no conflicts, military vehicles need to go from one place to another. Although head and taillights can be used in these situations, nighttime driving still presents serious risks. Many serious accidents occur at night, in fog, light rain, because the driver could not see the accident cause in time to prevent the collision.

Each year, thousands of nighttime accidents occur with military vehicles, many due to adverse weather conditions. Drivers lack the ability to quickly reduce speed, fatigue and stress can negatively affect reaction time, and vision gets severely impaired in the dark.

#### **Seeing in total darkness and through smoke in the most adverse weather conditions**

A new tool that can make driving during night time and in bad weather conditions safer, both in friendly and hostile territory, is thermal imaging. By allowing drivers to see thermal images of the road ahead – even in total darkness, through smoke, dust, light fog and rain- drivers are able to detect obstacles and potential hazards on or alongside the road, much sooner and have more time to react.

#### **Thermal imaging**

Thermal imaging cameras were initially developed for the military in the 1950's. Since it is able to produce a clear image in total darkness, thermal imaging technology

*Installed in military vehicles, the PathFindIR gives the driver the possibility to advance without lights and still clearly see what is happening without being detected. It also significantly increases situational awareness. The PathFindIR produces a crisp image in total darkness, through light fog, dust and smoke.*

provides the ability to see and target opposing forces through the darkest of nights, at extreme long distances. Thermal imaging can also see through smoke which makes it even more interesting for military use since it can see across a smoke-covered battleground.

Due to recent technological developments and volume production, also for civilian applications, thermal imaging cameras have become a lot more compact and far less expensive.

Thermal imaging is the use of an infrared camera to "see" thermal energy emitted from an object. Infrared energy can not be detected by the eye because the energy of the photons is too low to stimulate the photoreceptors in the eye. Also, thermal IR light does not get to the retina, because it is highly absorbed by the eye's lens and fluids. Infrared allows us to see what our eyes cannot - invisible heat radiation emitted by all objects regardless of lighting conditions. Thermal imaging cameras produce images of invisible infrared or "heat" radiation. Based on temperature differences between objects, thermal imaging produces a clear image.

Although there are other technologies available for night vision, thermal imaging outperforms them and has some advantages over them.





## Thermal imaging versus light amplification

Light amplification, also referred to as I<sup>2</sup> technology, amplifies small amounts of visible light thousands of times so that objects can be seen at night. Light amplification does require a certain level of ambient light, but even starlight can produce an image on a cloudless night. A high-end image intensified camera can produce outstanding images on a clear moonlit night.



Thermal image      I<sup>2</sup> image      Visual image

Because the system requires at least a minimum level of ambient light, conditions such as heavy overcast can limit its effectiveness. Similarly, too much light may overwhelm the system and reduce effectiveness. A driver confronted with someone shining a flashlight to him will be totally blinded. Furthermore, the driver needs to be wearing goggles when using I<sup>2</sup> technology. They can hinder the driver in his activities, especially when going over rough terrain.

Contrary to light amplification systems, thermal imaging works by detecting the heat energy being radiated. It needs no light at all and produces a clear image in the darkest environments. The image produced by thermal imaging cameras can be easily displayed on a small screen without obstructing the driver.

## Thermal imaging for driver vision enhancement

Thermal imaging is a powerful driver vision enhancement system, which significantly reduces the risks of night time driving and allows the driver to see up to 5x further than with headlights. It needs no light whatsoever to operate.



Even in total darkness, the PathFindIR allows seeing up to 5x further than with headlights.

Installed at the front of a vehicle, often behind a vehicle grill, thermal imaging helps drivers to see road edges better, see approaching curves earlier, detect obstructions in rough terrain but also to overcome momentary blindness from oncoming headlight glare, and to see through smoke, dust, light fog and light rain.

BMW started using this technology on its 7-, 6- and 5-series passenger cars to facilitate night time driving. Military vehicles that are used much more intensely

and in rougher circumstances than passenger cars can therefore certainly benefit from this technology.

## Increased situational awareness even in broad daylight

A thermal imaging camera can also be installed at other locations than at the front of the vehicle. When using armored personnel carriers, soldiers often need to disembark from the back of the vehicle. A thermal imaging camera installed at the back will allow the driver so see if troops can get out of the vehicle safely before opening the door. The driver will clearly see if enemy forces are behind his vehicle or not on a thermal image.



Installed in an Armoured Personnel Carrier (APC) the PathFindIR can significantly increase the situational awareness of the driver.

Also in broad daylight a thermal imaging camera will help to increase situational awareness. Enemy troops can not hide in the shadows. Even when they are hiding in the bush, totally camouflaged, a thermal imaging camera will detect hostile activity immediately.

Installed at the back of a vehicle, a thermal imaging camera can also help the driver to back away from dangerous situations at high speed. Without need for guidance by one of his passengers.

For even more situational awareness, thermal imaging cameras can also be installed at the sides of the vehicle. This way, the driver or commander of the vehicle, can monitor all activity around it.

## PathFindIR™: thermal imaging camera

The FLIR Systems PathFindIR is a compact thermal imaging camera which is ideal for integration in military vehicles.

The PathFindIR incorporates an uncooled 320 x 240 pixels microbolometer. This maintenance free system delivers crisp video images which can be displayed on virtually any display that accepts composite video. It is equipped with an 19 mm wide angle lens which gives the driver a wide field of view (36°), resulting in excellent situational awareness.

Designed for use in harsh weather conditions, the PathFindIR is Mil-Std810 rated and extremely rugged. Its vital core is well protected against humidity and water. It is sealed, and will endure road salts and extreme temperatures. The PathFindIR can be cleaned with a hose just like any other equipment. It operates between -40°C and +80°C and has a built-in heater to defrost its protective window. This heater is capable of defrosting a 2mm layer of ice frozen to the window within 15 minutes when ambient temperature is -30°C and wind speed against the window is 100 km/hr. The heater is automatically powered when window temperature

is less than +4°C and powered down when window temperature is more than +6°C. This ensures a clear lens and perfect infrared images displayed on your monitor even in very cold environments.

The PathFindIR can be used both in arctic and desert climates.

## Easy to install and easy to use

The FLIR Systems PathFindIR is a compact camera (5.8 x 5.7 x 7.2 cm) and weighs only 360 grams. It can easily be installed behind a vehicle grill or in any other compact location. A 6 meter long cable is available for routing the PathFindIR's power and video interface into the driver's compartment. On one side the cable connects to the PathFindIR. On the other end it has 2 wires that can be terminated, as required by the user, for hooking into the vehicle power bus and a video cable that is terminated with a BNC connector.

The images produced by the PathFindIR can be displayed on most standard monitors. There is no need whatsoever for the driver to look at the display continuously. The monitor becomes a natural checkpoint for the driver, similar to side view or rearview mirrors.

The PathFindIR can be installed in all types of military vehicles. Armored personnel carriers, support vehicles, trucks, command and reconnaissance vehicles, engineering and logistical support vehicles but also ambulances and fire trucks, they can all benefit from the power of a thermal imaging camera like the PathFindIR.

## Affordable solution to save lives and money

Not only huge accidents involving injuries or death cost a tremendous amount of money. Driving over unseen obstacles can cause damages to a military vehicle. Repair cost can make even a small accident an expensive thing. Furthermore, an accident in hostile territory can bring the lives of many soldiers, and even an entire operation, in danger. Installing a FLIR Systems PathFindIR is a small investment that can avoid many hazards.



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