



Thermal imaging for maritime applications

Discover a wide variety of applications



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1 Introduction



FLIR Systems: the world leader in thermal imaging cameras

FLIR Systems is the world leader in the design, manufacturing and marketing of thermal imaging systems for a wide variety of commercial and government applications.

Rapidly emerging markets and organization

Interest for thermal imaging has grown considerably over the last few years in a large variety of markets. To face this increased demand, FLIR Systems has expanded its organization drastically. Today we employ more than 4,000 people. Together, these infrared specialists realize a consolidated annual turnover of more than 1 billion US dollars. This makes FLIR Systems the largest manufacturer of commercial thermal imaging cameras in the world.

Manufacturing capabilities

FLIR currently operates 6 manufacturing plants: three in the USA (Portland, Boston and Santa Barbara, California) one in Stockholm, Sweden, one in Estonia and one near Paris, France.



FLIR, Sweden



FLIR France



FLIR, Boston, USA



FLIR Santa Barbara, USA

All markets and all applications

FLIR Systems is totally focused on thermal imaging cameras. No other manufacturer produces more thermal imaging cameras than FLIR Systems.

FLIR Systems is active in all markets where thermal imaging cameras are being used: security, maritime, automation, process control are just a few markets in which FLIR Systems thermal imaging cameras have proven their worth.



2 The thermal imaging camera and how it works

A thermal imaging camera records the intensity of radiation in the infrared part of the electromagnetic spectrum and converts it to a visible image.



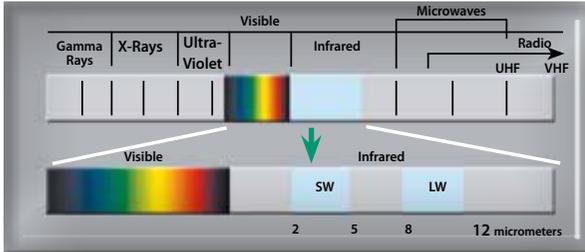
What is infrared?

Our eyes are detectors that are designed to detect electromagnetic radiation in the visible light spectrum. All other forms of electromagnetic radiation, such as infrared, are invisible to the human eye.

The existence of infrared was discovered in 1800 by astronomer Sir Frederick William Herschel. Curious to the thermal difference between different light colors, he directed sunlight through a glass prism to create a spectrum and then measured the temperature of each color. He found that the temperatures of the colors increased from the violet to the red part of the spectrum.

After noticing this pattern Herschel decided to measure the temperature just beyond the red portion of the spectrum in a region where no sunlight was visible. To his surprise, he found that this region had the highest temperature of all.

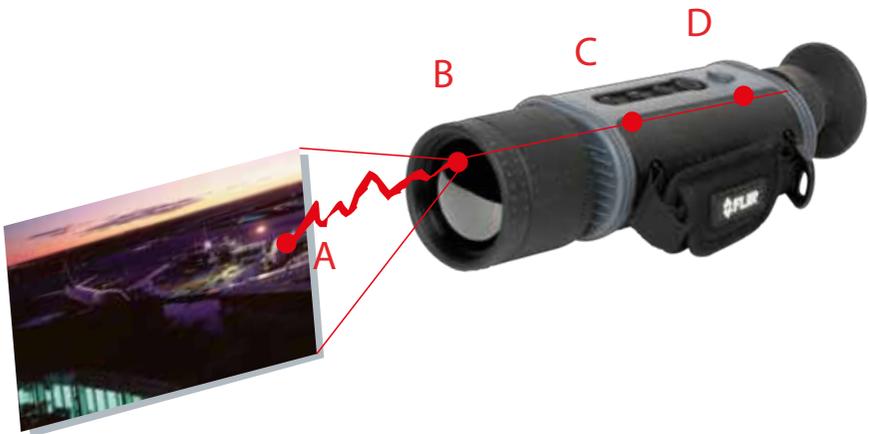
Infrared radiation lies between the visible and microwave portions of the electromagnetic spectrum. The primary source of infrared radiation is heat or thermal radiation. Any object that has a temperature above absolute zero (-273.15 degrees Celsius or 0 Kelvin) emits radiation in the infrared region. Even objects that we think of as being very cold, such as ice cubes, emit infrared radiation.



We experience infrared radiation every day. The heat that we feel from sunlight, a fire or a radiator is all infrared. Although our eyes cannot see it, the nerves in our skin can feel it as heat. The warmer the object, the more infrared radiation it emits.

The thermal imaging camera

Infrared energy coming from an object is focused by the optics onto an infrared detector. The detector sends the information to sensor electronics for image processing. The electronics translate the data coming from the detector into an image that can be viewed in the viewfinder or on a standard video monitor or LCD screen.



3 Seeing in total darkness in a maritime environment

The advantages of thermal imaging

Practically all of us associate the sea with holidays and fun, but it can be a dangerous place, especially in nighttime and bad weather. Yachts collide with other vessels, run on cliffs or other objects resulting in heavy damages and sometimes even loss of life. Some of these accidents happen in open water, others while navigating in harbors and ports.

Our eyes are the first line of defense against these hazards. Unfortunately, eyes are not the best detectors at night or in bad weather. Any accident at sea does not only have severe consequences for the vessel but also for its passengers and crew. A number of tools are available to help us detect potential dangers before they become a real hazard.



Normal vision



Thermal vision

Thermal imaging:

An excellent tool to help you see at night is thermal imaging. Thermal imaging cameras do not need any light whatsoever to produce a crisp image. They are very effective in maritime environments. They can detect objects floating in the water which may damage a vessel, or even worse, sink it. Other vessels, shipping lane traffic buoys, bridges, ... it is all seamlessly detected by thermal imaging. Although there are other technologies available for helping you to navigate during the night and to help you prevent catastrophes, thermal imaging outperforms them, has some advantages over them or it can complement them.

Thermal imagers are excellent tools for short to medium range threat detection. Today, more than ever, shipboard security is important. Thermal imaging allows you to see what is around you, even at long ranges. You can monitor activity in port or at anchor and see approaching vessels or people without alerting them that they are being watched.

Thermal imaging for maritime applications



Man overboard search



Night docking



Shipboard security



Nighttime navigation



Oil spill detection



Daytime navigation



Ice detection



Anti-piracy

Each year, numerous people die after falling overboard and not being found fast enough. Thermal imaging can help find a person in the water before it is too late.

Thermal cameras work during the day as well, and give users the ability to see through marine haze more effectively than with the unaided eye. It is not affected by glare from the sun.

Light amplification

Light amplification, also referred to as I² 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. 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 its effectiveness.

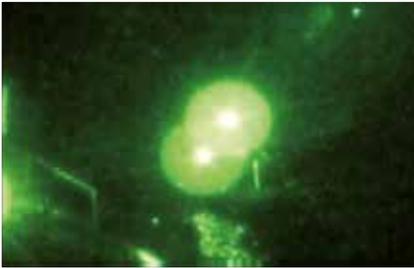


Image intensification: image is saturated by looking directly at a light source.



Thermal imaging: is not affected by the light and produces a clear image.

Navigation lights

Even when all boats have proper lighting, it's very difficult to judge bearings and closure rates. Navigation lights become less useful when fog or rain is obstructing your view. You might see an approaching vessel too late which can lead to lethal accidents.

Visualize RADAR blips

Today radars are installed on practically every yacht. The limitation of RADAR is that it only gives you a small blip on the screen when it is detecting an object. A thermal imager will give you a real image of the situation. This will help you to determine whether a certain object is a real danger or not.

4 Our customers testify

FLIR Systems has many customers that are active in a wide variety of markets. FLIR Systems thermal imaging cameras are being used by a wide variety of people.

All of them have discovered the benefits that thermal imaging has to offer.

Many have chosen for a FLIR Systems thermal imaging camera. They have acknowledged that FLIR Systems produces the most advanced and the most user friendly systems.

On the following pages you will find a couple of short testimonies of users of FLIR thermal imaging cameras. It are these users that are the best promotion for thermal imaging technology and for FLIR Systems.

Do not take it from us. Read what the users of FLIR thermal imaging cameras have to say.



Genoa Pilot Corps installs FLIR thermal imaging camera on board of its vessels.

The Genoa Pilot Corps is concerned about its port pilots. They do not only take every precaution to avoid accidents, they also take the necessary measures to rescue the port pilot in the event that an accident would take place. That is exactly why they decided to put a thermal imaging camera on one of their pilot boats.

The experience with the FLIR M-Series have been great so far. The captain that is using it on his vessel is very enthusiastic. The great feedback they received about the FLIR thermal imaging camera made the Genoa Pilot Corps decide to put FLIR thermal imaging cameras on their other vessels as well.



The FLIR M-Series has been mounted in the "ball down" position on board of the pilot boat.



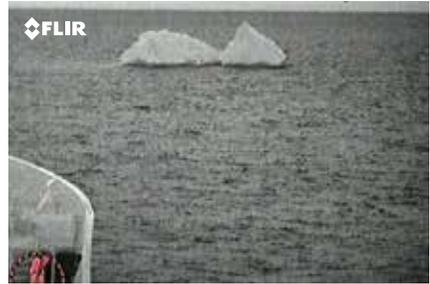
The FLIR M-Series does not need any light whatsoever to produce a crisp image.



Stepping from the pilot boat to the commercial vessel that needs to be piloted is a dangerous operation. If an accident should occur a person floating in the water can be easily found, also in total darkness, with the FLIR M-Series thermal imaging camera.

Thermal imaging, a great tool for ice detection.

FLIR Systems set out to determine how its maritime cameras perform in the field. For this field test two versions of the FLIR M-Series thermal imaging camera were mounted on a tripod next to the bridge of an ice strengthened vessel traversing Greenland's ice filled waters to deliver fuel to remote settlements.



This sequence of thermal images shows the approach of two bergy bits.

Thermal imaging cameras can be used to detect ice because the ice is generally much colder than the surrounding ocean. Not only do the temperatures of the ice and the seawater differ, in most cases there is also a difference in emissivity.

FLIR thermal imaging cameras on board of Ferretti yachts.

More and more yacht owners are incorporating FLIR thermal imaging cameras in their vessel's set of equipment. One of the first to realize the potential of this innovative technology is Norberto Ferretti, chairman of the Ferretti Group.



Thermal image of a harbour.



The FLIR M-Series contains both a thermal imaging camera and a daylight/lowlight camera.



Riccardo Tebaldi, part of the Ferretti Group Delivery team, uses a HM-Series handheld thermal imaging camera.

*"I've been using FLIR thermal cameras for four or five years now and it really is a great tool that helps to keep my yacht safe. In some situations it's actually even better than the radar."
Norberto Ferretti, chairman of the Ferretti Group.*



The Ferretti Group is one of the leading yacht builders in the world.

Thermal imaging helps ensure boater safety on Lake Constance.

The beautiful Lake Constance is traversed by hundreds of people each year. A number of rescue societies make sure that these people can safely enjoy its wonders. On the Swiss side of the lake that task is fulfilled by the 'Seerettungsdienst Arbon', with the aid of a FLIR M-Series thermal imaging camera.



Mr. Meyer was surprised to see the amount of detail in the thermal footage produced by the FLIR M-Series thermal imaging camera. "As soon as I saw the remarkable image quality it was immediately convinced."

"We wanted to make sure we can deploy our rescue boats regardless of the lighting conditions," explains Eric Meyer of SLRG Arbon. "Several cases have shown that rescue operations with searchlights alone can be very difficult. In man overboard situations just a few seconds can make the difference between life and death."



On the high contrast thermal images people and vessels show up clearly, even in complete darkness.



The FLIR M-Series thermal imaging camera is mounted on top of the bridge to provide a good range performance.



The FLIR M-Series' Joystick Control Unit is seamlessly integrated in the bridge.

FLIR Systems turns night into day.

The sea and rivers can also be dangerous places. Especially in night time or bad weather. Most accidents happen when visibility is limited. In darkness or in light fog. Ships collide with each other, hit bridge pilings, exposed rocks and floating objects. This can result in heavy damages to the vessel or even worse, loss of life.



Visual image



Thermal image



The FLIR Systems thermal imaging camera installed on the "Allure" produces clear thermal images on which the smallest of details can be seen. In total darkness, in practically all weather conditions.

"The FLIR thermal imaging camera is a lot easier to use than radar. It produces a crisp image on which the smallest of details can be seen."



The images of the FLIR Systems thermal imaging camera are displayed on a standard LCD display.

Avoiding collisions in port and in open water.

The cement carrier used by the Golden Bay Cement Company is the M.V. Golden Bay with a capacity of 4,500 tonnes. In order to increase safety on board, a thermal imaging camera was installed. It helps the captain to navigate at night. It increases the safety of the vessel and its crew.



The FLIR Systems thermal imaging camera was installed just above the bridge of the M.V. Golden Bay.



The Joystick Control Unit for the thermal imaging camera is integrated in the bridge.



The M.V. Golden Bay: a cement carrier with a capacity of 4,500 tonnes.



The FLIR Systems thermal imaging camera produces a crisp image which is projected on a 20" LCD screen installed on the bridge.

"We are not only very concerned about safety. Our own safety but also the safety of other vessels and their crew." says Mr. Robinson, captain on the M.V. Golden Bay. "In order to avoid deadly accidents at night, we looked for a solution that could help us to detect small boats and objects that are not detected by radar. Thermal imaging was the solution."

Inland skippers use thermal imaging to navigate through tight spots at night.

Inland skippers are faced with the daunting task of navigating their long bulky barges through tight locks and bends. When darkness or light fog impedes regular vision, searchlights are used to enhance the skipper's situational awareness. But now there's another tool on the market: FLIR thermal imaging cameras.



Mr. Bach admits that he mainly looks at the thermal footage of the FLIR M-Series when crossing an upcoming vessel at night.



The FLIR M-series allows to navigate and dock the ship. It also helps to detect intruders while docked.



The barge combination 'El Niño', 'La Niña' is 185 meters long and 10.5 meters wide and it can transport 4,422 Tonne of cargo.



The thermal imaging camera is mounted on top of the bridge to provide maximal situational awareness.

"The first time I saw thermal imaging cameras demonstrated on the barge of one of my colleagues I immediately knew I had to get one for my own barge combination.," explains German inland skipper Rolf Bach.



When Rolf Bach saw a demonstration of the FLIR M-Series he immediately knew he had to buy one for himself.

FLIR M-Series helps to avoid collisions and to ensure passenger safety at the Lisbon ferries.

Several ferries are travelling up and down the Tagus river in Lisbon, Portugal all day. But it's not just ferries crossing the river: ships of all sizes and shapes traverse the Tagus. And when darkness or smoke impedes vision this can lead to dangerous situations. To avoid collisions, the new Lisbon ferries have been enhanced with FLIR M-Series thermal imaging cameras.



The Lisbon ferries with a FLIR M-Series.

The FLIR M-Series thermal imaging camera has been mounted on top of a pole to provide a better overview and enable a better range performance, for the higher the camera is located the better it can enhance the captain's situational awareness.



Visual image



Thermal image

The FLIR M-Series thermal imaging camera helps to avoid collisions even if light fog, smoke or darkness impedes vision.



The thermal imaging camera is mounted on a pole for a better situational awareness and a better range performance.



The FLIR M-Series thermal imaging camera's control unit is seamlessly incorporated in the bridge.

With a thermal imaging camera down the Neva.

The Neva River is an essential part of St. Petersburg's charm. A FLIR Systems thermal imaging camera, installed on a Sunseeker yacht, helps to navigate during the long dark nights.



The "Tortuga", a Sunseeker yacht, with the FLIR Systems thermal imaging camera installed above the bridge.



Boating season is short in Russia, due to the weather conditions. Owners want to use their yachts as much as possible.



Total darkness



Thermal image

"But for sailing on rivers and coastal waters the radar loses its importance. Modern high speed boats do not give the captain time to analyze radar images. A thermal imaging camera offers a real time image which can be easily understood by any captain."



Mr. Gorbunov, owner of the "Tortuga" and Mr. Grishin, from Radio-Navigator, a FLIR Systems maritime distributor.

FLIR cameras help save lives in Norwegian waters.

Everyone that has been at sea at night will agree that being able to see in the dark is a very important asset to any sailor, but for the Norwegian Society for Sea Rescue (NSSR) it quite literally makes the difference between life and death.



Kent Andersen operates the FLIR M-Series thermal camera on the bridge of the Gideon. "It rapidly became part of my routine to check what's on the FLIR camera."



The ability to see at night with the FLIR Systems thermal imaging camera allows the crew to save human lives.



Four people peddling along in canoes, as seen from the daylight camera.



The same four canoe enthusiasts stand out very clearly on the FLIR thermal imaging camera.

"Each search and rescue society should equip their vessels with FLIR cameras," claims Search and Rescue Inspector Ronny Pedersen. "I am absolutely certain that these cameras will save human lives. It's really just a matter of time."

FLIR thermal imaging cameras ideal for oil detection.

Oil recovery is an important task that needs to be performed quickly and effectively in order to be successful. FLIR thermal imaging cameras are an ideal tool to help the oil recovery teams to do their job effectively.



Visual image and thermal image of oil that escaped from the Deepwater Horizon as it sunk. Note that the oil is much easier to spot on the thermal image.

The detection of oil spill is based on the differences between oil and water in temperature, thermal reflection and thermal emissivity. Due to a difference in thermal conductivity oil will usually absorb heat faster during the day, thus it becomes warmer than the surrounding sea water. This makes it show up on the thermal images as a hot spot. During the night, the opposite is true; the oil body will lose heat faster than the surrounding water, which makes the oil show up as a cooler region.



A visible image and a thermal image of Doba/Chad crude oil, at a low camera angle, a glassy calm sea state, in full daylight.

FLIR Systems thermal imaging cameras find their way to Sunseeker yachts.

Few brands can confidently claim to rank amongst the world's finest, Sunseeker is one of them, it is a brand with enormous global strength. Thermal imaging cameras can be ordered as an option on every yacht.



A 34 Metre Yacht during construction at the yard in Poole, UK.



The same 34 Metre Yacht. The FLIR Systems thermal imaging camera is mounted on top of the mast.



A Flybridge yacht with a FLIR Systems thermal imaging camera installed.



The Joystick Control Unit is aesthetically integrated into the helm console on board a Sunseeker 34 Metre Yacht.

"When I introduced the FLIR Systems thermal imaging cameras to Sunseeker, they were immediately enthusiastic," says Paul Rees, Sales Director of Ships Electronic Services Ltd. distributor of FLIR Systems maritime products in the UK. "The technology of thermal imaging was already known to Sunseeker but they were surprised by the high quality thermal images that are delivered by the FLIR thermal imaging cameras."

5 FLIR Systems, the world leader for thermal imaging cameras

FLIR manufactures the most advanced thermal imaging cameras on the market today. We offer a wide variety of models so that you can choose the thermal imaging camera that is perfectly suited for your specific maritime needs.

FLIR MD-Series

This affordable, fixed-mount thermal night vision system helps with steering around obstacles, collision avoidance and finding people in the water at night. Simple to mount and easy to integrate into your existing electronics.



FLIR M-Series

Powerful, flexible, and built to last, the award-winning M-Series is FLIR's premium line of maritime thermal night vision systems. Available with a variety of sensors and resolutions to meet a wide range of maritime navigation, collision avoidance, security, and search and rescue needs, M-Series is easy to install, integrate, and operate.

FLIR Voyager

Voyager II / Voyager III's thermal camera lets you detect other boats or hazards easily. Equipped with continuous thermal zoom it's no surprise that Voyager II / Voyager III is the proven anti-piracy system of choice for yachts, police boats, and cargo vessels around the world.





FLIR MU- / MV-Series

They are the most technologically advanced thermal night vision system available to the maritime industry today. They are powerful, gyro-stabilized multi-sensor, long range, thermal night vision systems. A version with a cooled thermal imaging camera as well as version with an uncooled thermal imaging camera are available. All systems are equipped with a powerful optical zoom on the thermal image. Up to 4 different cameras can be integrated in one system.

Handheld thermal imaging cameras

FLIR Systems also markets a full range of handheld thermal imaging cameras that have been especially developed for use in a maritime environment. The user can choose between monocular and bi-ocular versions according to his preference. Different image qualities are available.



FLIR MS-/MLS-Series



FLIR HM-Series



FLIR BHM-Series

6 Thermal imaging: a wide variety of applications

As more and more people are discovering the benefits that thermal imaging cameras have to offer, volumes have gone up and prices are coming down. This means that thermal imaging cameras are finding their way to more and more markets. FLIR Systems has the correct camera for every application.

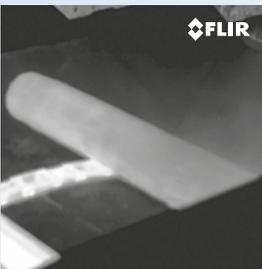


Maritime

On both yachts and commercial vessels, FLIR thermal imaging cameras are being used for night time navigation, shipboard security, man-overboard situations and anti-piracy.

Electrical / Mechanical

In industrial environments thermal imaging is used to find hot-spots that can lead to failures in electrical and mechanical installations. By detecting anomalies at an early stage production breakdowns can be avoided and money can be saved.

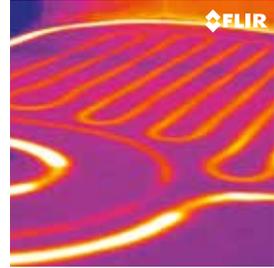


Cores & components

FLIR Systems also markets a wide variety of thermal imaging cores that other manufacturers integrate in their own products.

Building diagnostics

Building professionals look for insulation losses and other building related defects with a thermal imaging camera. Finding insulation losses and repairing them can mean huge energy savings.

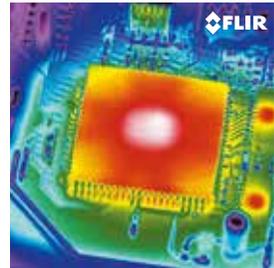


Border security

Border security specialists protect their country's border against smugglers and other intruders. With a thermal imaging camera they are able to see a man at a distance of 20 kilometers away in total darkness.

Science / R&D

Thermal imaging also plays a pivotal role in both applied and fundamental R&D. It can speed up the design cycle so that products can go to market faster. For these demanding applications FLIR Systems markets extremely high performance thermal imaging cameras.



Security

Our security customers benefit from thermal imaging cameras because they help them to secure facilities like ports, airports, nuclear facilities, warehouses, estates and many more against intruders.

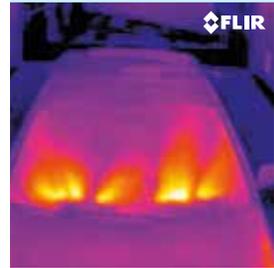


Transportation

FLIR thermal imaging cameras are installed in cars for driver vision enhancement. They help the driver to see up to 4 times further than headlights. They are also installed in specialty vehicles such as fire-trucks, mining and military vehicles.

Automation / process control

Thermal imaging cameras are also installed to continuously monitor production processes and to avoid fires.

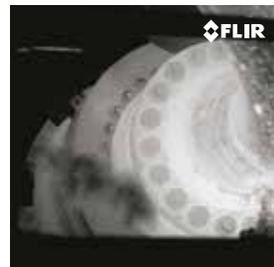


Law enforcement

Police officers use the power of thermal imaging to see without being seen. They can easily find suspects in total darkness without giving away their position.

Optical gas imaging

Gas leaks can also be detected seamlessly with a thermal imaging camera.





Personal vision systems

Outdoor enthusiasts can see clearly at night with the help of a thermal imaging camera.

Firefighting

Firefighters are able to see through smoke. It helps them to find victims in a smoke filled room and also to see if fires are well extinguished. It helps them to save lives.



Extech

Under the Extech brand, FLIR systems is marketing a full line of test and measurement equipment.

7 Selecting the correct thermal imaging camera manufacturer

Since thermal imaging cameras have become increasingly popular over the last few years more and more manufacturers are starting to produce thermal imaging cameras.

Regardless of your application, there are some considerations to take when investing in a thermal imaging camera.

The correct camera for the correct application

Choose a thermal imaging camera manufacturer that offers you a choice. Different applications require different types of thermal imaging cameras. First time users have different needs than those that have already discovered the benefits of thermal imaging. Different image qualities are available. A reliable manufacturer offers you a thermal imaging camera that is completely suited for your application.



Choose a system that can grow with your needs

As you start to discover the benefits thermal imaging has to offer your needs will undoubtedly change. Go for a manufacturer that is able to take your first camera back and offer you a more advanced model. Make sure that accessories are available.





Service

Once in operation a thermal imaging camera rapidly becomes a vital piece of equipment. Make sure that the manufacturer can service your camera in the shortest period of time if a problem should occur.

Training

Using a thermal imaging camera is as easy as using a camcorder. There are however some things you need to take into account. A reliable thermal imaging camera will be able to give you initial or extensive training so that you can get the most out of your thermal imaging camera.





Send us your application

On the previous pages you could read how some of our users are using FLIR thermal imaging cameras.

We are always looking for new application stories and new customer testimonies. If you have an interesting application please contact us. We will be happy to include you in the next edition of this booklet.

Please fill out the following form, scan it and send it to flir@flir.com or fax this form to +32 3 303 56 24

Company : _____

Name : _____

Address : _____

Postal Code : _____

City : _____

Country : _____

Tel : _____

Application : _____

Short Description : _____



Notes

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