FLIR Advanced Thermal Solutions

Providing thermal solutions for R&D and Science and development researchers

Thermal cameras are today being used in many different ways as more and more people realize the potential of this powerful imaging technology. Thermal cameras made by FLIR play pivotal roles in a wide range of industrial, commercial and government activities in more than 60 countries worldwide.

For the demanding environment of Research & Development - FLIR has recognized the need for specialised high performance thermal imaging systems. To support the wide and varied demands of this market - FLIR Systems created a separate business unit (FLIR Advanced Thermal Solutions) in France, near Paris, that concentrates on producing high specification thermal imaging cameras that deliver top quality results from even the most challenging applications.

Loïc Premartin is Sales Director EMEA for FLIR Systems' Research and Development product portfolio. According to him the A in ATS is there for a reason. "Here at ATS we can literally provide the most advanced thermal solutions for R&D. We have about 50 people fully dedicated to the most advanced technology available on the market in terms of optoelectronic design, performance and hardware / software capabilities. We are operating on the cutting edge of thermal technology. If you compare thermal imaging cameras with cars, the cameras we produce here are the Formula 1 cars. They are simply the best of the best."

That means that there can be no compromise, according to Loïc Premartin. "The difference with other markets for thermal imaging is that we're not concentrating on just reducing production costs. Although this is an important factor, our key aim always is to optimise performance. That means: leading-edge optoelectronic design, perfect

At FLIR ATS there are about 50 people dedicated to finding the best thermal solutions modern technology has to offer.

These SC5000 series cameras are ready to be shipped to clients.

The FLIR ATS facility in Marne La Vallée, near Paris, as seen from the air.

The SC5000 thermal camera is available with a wide variety of different lenses.

drift compensation, an ultra-stable camera platform , better temperature measurement accuracy, adjustable integration time in image acquisition, advanced filtering capabilities, microscopic magnification or long distance lenses with a narrow field of view, to push all that to the very limit of what's possible, that's our challenge."

Cooled and uncooled

That doesn't necessarily mean that everything ATS produces is as advanced as the other. "We have a very wide product range, with both cooled and un-cooled detectors and all kinds of lenses, filters and other equipment. This allows us to deliver thermal solutions for every possible application and any possible budget."

Although the un-cooled thermal cameras have improved a great deal in the last couple of years, when it comes to advanced thermal solutions the cooled cameras are still the best, according to Loïc Premartin. "Cooled cameras are much more sensitive to small differences in temperature."

Solutions for every kind of budget

Another difference between cooled and uncooled cameras is the frequency and windowing possibilities. "By narrowing down the area you're looking at, you can record more frames per second, enhancing the frequency. Normal video is recorded at 25 frames per second so that's 25 Hz. With our cooled cameras we can capture images up to a frequency of 65000 Hz by using our advanced windowing technology to the maximum. With an uncooled camera we can go to 200 Hz at the maximum of windowing capability. So there is still a very big difference."

But Loïc Premartin stresses that the uncooled cameras aren't less important. "We need to provide solutions for every possible application and any possible budget. So that includes the uncooled cameras."

The importance of flexibility

When supplying the research and development market you have to be very flexible, according to Loïc Premartin. "If you're producing cameras for other markets like the automobile industry or the maritime market you can make a camera that suits all customers' needs. In the research and development market, however, it is not that straightforward. Our customers are universities, research institutes, but also the military, for target-signature for instance, and industrial companies that use our cameras for electronic thermal evaluation, quality control, heat transfer analysis or for non-destructive testing. These customers have very specific and different needs, so when you are supplying the R&D market you have to be flexible. Our wide product range and our long list of additional accessories (lenses, filters,...) and our dedicated software modules allow us to offer the best solutions for each application request.

"We can provide all kinds of research and development solutions," continues Loïc Premartin. "Made to fit the client's specific needs and if necessary we will develop something special for that client. For instance, we recently sold a thermal imaging system to a star observation research center in Russia that had to be able to detect temperatures as low as -80° C. To be able to do that we took the camera we had and pushed the limit of the performance in the lower parts of the temperature range to fit the customer's needs. I think that's one of the main differences between FLIR ATS and other FLIR business units."

American or European license: a big difference

Before FLIR ATS, supplying the research and development market in Europe with such flexible solutions proved to be difficult, according to Premartin. "FLIR has a very good research and development team in the USA, but the American licensing system made it very difficult to export their thermal solutions to Europe. Being able to produce thermal solutions here under a European license reinforced positively our leadership in EMEA, allowing us to quickly and efficiently supply research and development clients with the thermal solutions they need."

A wide range of thermal systems

FLIR ATS cameras are the thermal imaging solution of choice for almost any industrial, scientific or military application when flexibility and leading edge performance is required. In addition to the uncooled FLIR SC300 and FLIR SC600 Series, FLIR also offers a large range of ultra fast, ultra sensitive cooled IR cameras – the FLIR SC5000 and FLIR SC7000 Series – and Near Infrared (NIR) cameras,

All components of the camera, including the detector, the lenses and the mechanical and electronic parts are engineered and developed in the ATS facility in France.

the FLIR SC2000 Series. These cameras provide superior measurement capabilities in challenging situations or setups, such as a setup with fast motion or where you need to see a fast thermal event. In addition these cameras enable you to record thermal images over a wide temperature range, phenomena with low amplitude, evaluate very small objects and even allow you to do multispectral analysis. Additionally, the FLIR SC2000 Series will also be useful for those situations where the NIR spectral band (the SC2000 detects frequencies in the 0.8 µm to 2.5 µm bandwidth) offers measurement advantages such as laser profiling, paint analysis, silicon wafer inspection and high temperature measurement.

As complementary tools to these Advanced Thermal Imaging systems, FLIR ATS also delivers digital image processing software that's capable to offer research and development specialists all the necessary functionalities for ultra-fast and real time image acquisition, accurate triggering, lock-in thermography and stress analysis.

Easy to use

To completely control the quality of the camera FLIR produces all of the camera's components itself. "At FLIR ATS we try to have the best possible components for each part of the camera", explains Premartin. "Our engineers design all hardware and software themselves. All the mechanical and electronic components are engineered and developed right here in this facility. Not only does the in-depth expertise of our infrared specialists ensure the accuracy and reliability of all the vital components, it also makes our cameras extremely easy to use."

All the camera's components are designed and produced right here at FLIR ATS in France.

And that policy also extends to the heart of the camera: the detector. "The infrared detector absorbs infrared radiation and converts it into an electrical signal and as such it is the primary component of all thermal imaging systems. FLIR Systems is the only infrared camera manufacturer that operates its own detector manufacturing facility. We produce InSb (Indium Antimonite) detectors for cooled systems, but also vanadium oxide and InGaAs based detectors for un-cooled systems."

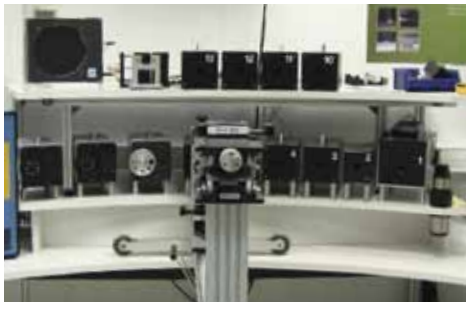
Focusing on the optics

Although the detector might be the heart of a thermal imaging system, the cameras optics are just as critical in ensuring optimal performance. "To ensure the quality of the optics we produce them ourselves. If you look at it, the optics of an infrared camera are quite similar to those of a normal camera, but you can't use the types of glass that are normally used in a regular camera for thermal imaging camera optics, because regular glass doesn't transmit infrared radiation, not as much as you need it to anyway. We therefore use lenses made of germanium. This expensive material has excellent mechanical properties and does not break easily, but that also means that it's difficult to work with, so we have to use diamonds to cut this extra hard material in the right shape. Again FLIR ensures the top quality of these vital camera components by producing the required IR lenses and mirrors using its own diamond-turning machinery."

The thermal cameras are carefully assembled by hand.

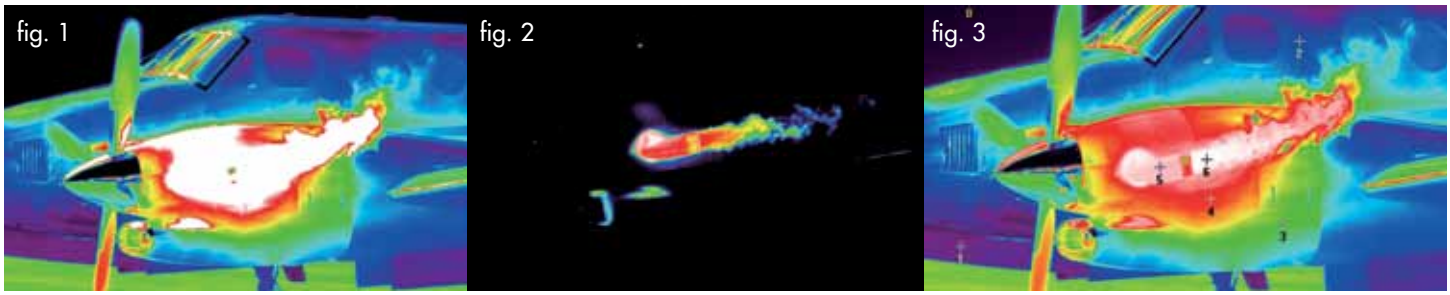
Largest collection of blackbodies

To be able to accurately measure temperature using a thermal imaging system, the final stage of calibration is also very important. "Calibrating the camera ensures that each and every pixel is able to measure temperatures accurately. The camera is placed in front of a temperature reference black body and it is checked that each pixel measures exactly the same temperature. Here at FLIR ATS we have a very large collection of blackbodies, to my knowledge the largest



FLIR ATS has the largest collection of blackbodies of any nongovernmental entity in Europe

FLIR ATS offers a wide range of cameras with numerous flexible options. At FLIR ATS there is a thermal solution for every possible application and for any budget.



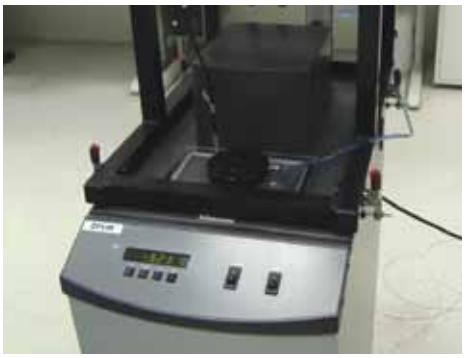
Superframing: Figure 1: 2-millisecond image: saturated exhaust system. Figure 2: the 30-microsecond image shows the exhaust system very clearly without saturation, but the rest of the scene is too cold to see clearly above the system noise floor. Figure 3: The solution: a picture both high in contrast and wide in temperature range.

of any non-governmental entity in Europe. In the example I mentioned earlier where a Russian star observatory wanted to observe temperatures as low as -80° C, we purchased a unique blackbody that allows us to calibrate our cameras at such low temperatures. Using that blackbody we could make sure that our equipment is very accurate, even when the amount of thermal energy emitted by the object is very low. By comparison we also have a black body source that's capable of calibration up to 3000° C. By maintaining this wide range of calibration capabilities we can ensure that our clients receive the most accurate temperature readings possible in every possible temperature range."

At the final stage every FLIR ATS camera goes through is quality testing. Every camera undergoes a number of stringent quality tests. "Each camera is exposed to the most adverse conditions in specially designed climatic chambers. This ensures that our camera systems perform accurately even in the most extreme conditions."

Special features

"Although all our thermal imaging cameras, for whatever application they are being used, are designed and manufactured according to the most modern criteria,



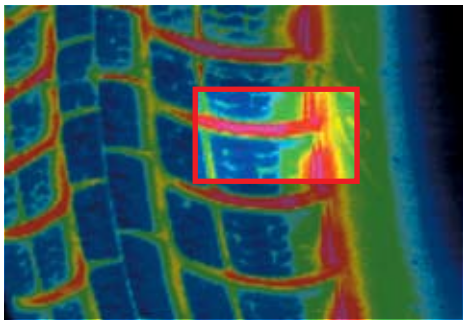
FLIR ATS recently purchased a unique blackbody that can calibrate thermal cameras at temperatures as low as -80° C.

FLIR Systems realizes that thermal imaging cameras for high-end R&D specialists require special features", Premartin explains. "In order to facilitate the work of researchers, FLIR Systems has developed a number of FLIR proprietary features that are extremely useful for researchers in all fields."

One example is FLIR CNUC. "That's a proprietary calibration process that provides extremely beautiful imagery and measurement from a FLIR thermal imaging camera. A camera calibrated with CNUC allows for flexible integration time adjustments without the need to perform non-uniformity corrections. Additionally the CNUC calibration produces accurate measurement stability regardless of camera exposure to ambient temperature variations."

Another useful tool is FLIR HyperCal. This allows the user to set the lower and upper limits of the temperature range and the camera will automatically adjust to the appropriate integration time. "This feature renders factory set temperature ranges as a thing of the past and ensures the best measurement range with the highest possible sensitivity."

FLIR ATS cameras also come with Automatic Superframing Capability. "If the scene's temperature range is too wide, the thermal imaging camera will automatically switch to Superframing mode enabling accurate temperature measurements over a wider temperature range." The technique of Superframing consists of varying the exposure, or integration time of the camera from frame to frame in a cyclic manner and combining the resulting sub-frames into single super-frames with greatly extended temperature ranges, which



Thermal image of a tire during a quality test done at 200km/h.

allow to visualize scenes featuring extreme temperature differences.

"When flexibility and top performance is required, I hope that you can now see that FLIR ATS thermal imaging camera's are a natural first choice for R&D specialists whatever their industrial, scientific or military applications challenge", concluded Loïc Premartin.

Loïc Premartin inspects a camera lens. "We want to make sure all components are perfect before we send the camera to the client."

For more information about thermal imaging cameras or about this application, please contact:

FLIR ATS
19 Boulevard Bidault
Croissy Beaubourg, F77183
FRANCE

Phone : +33 (0)1 60 37 01 00
Fax : +33 (0)1 64 11 37 55
e-mail : research@flir.com
www.flir.com

T820172 {EN-UK}_B