

Beyond light
we see
heat

HIGH PERFORMANCE
CAMERAS FOR
RESEARCH, SCIENCE
& ENGINEERING



Thermal Vision
 *Research*

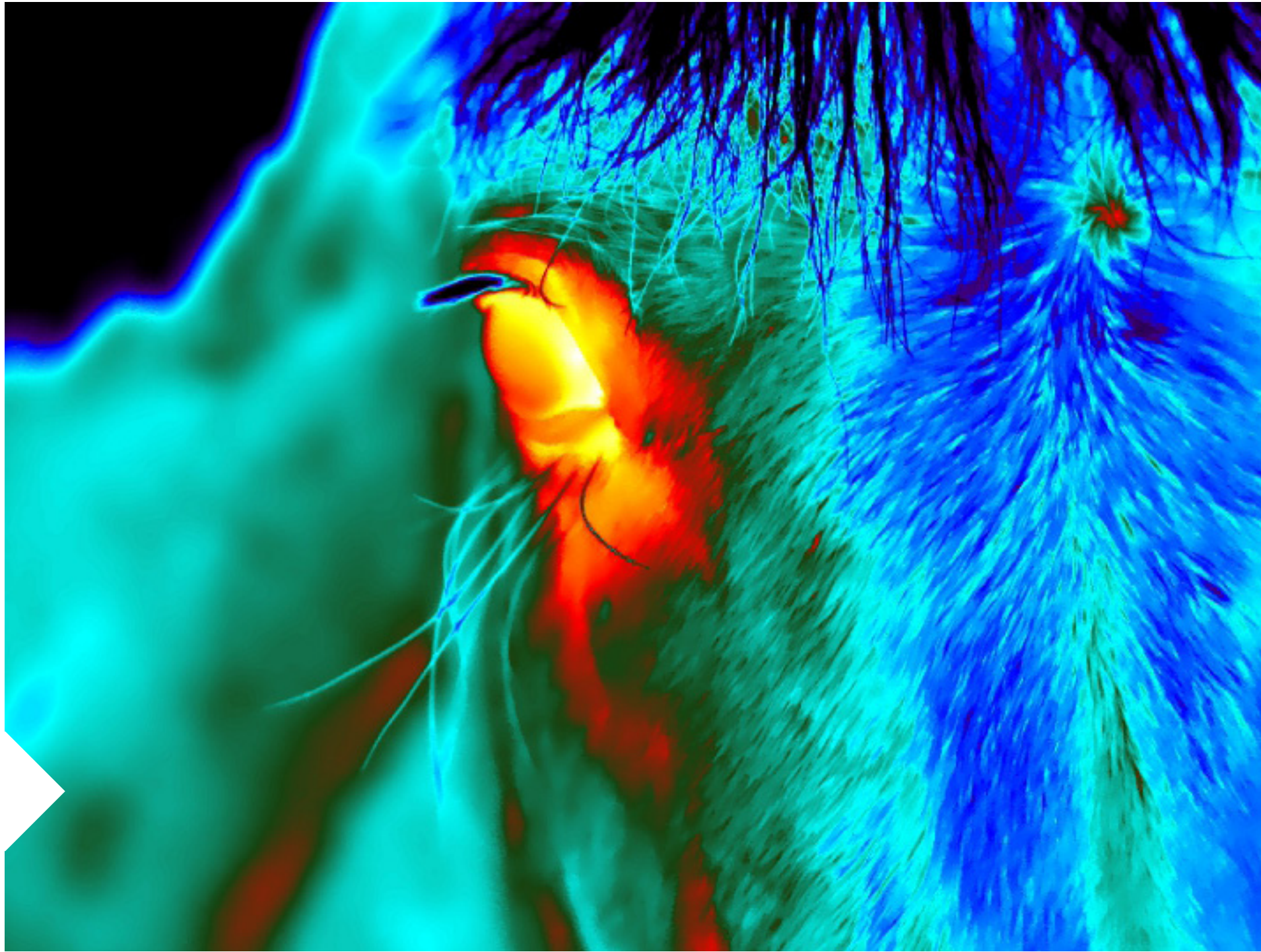


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About us

Thermal Vision Research Ltd (TVR) has over 10 years' experience in the thermal imaging market. Founded by entrepreneur Matthew Clavey, we supply FLIR's range of specialist IR thermography cameras for the **research and development (R&D)** market.

Whether you work for a blue chip company, a national organisation or are an engineer, scientist or inventor developing a project on a smaller scale, we'll be able to tailor a camera package to suit your project and budget. This brochure is an introduction to the **services we provide**, but nothing compares to the personal approach.

What makes us unique is that many of our cameras are not widely available in the UK – and combining this with the tailored software packages and the expert technical support our team provides, we offer a bespoke solution to our clients which cannot be matched by any other UK distributor.

From **equipment** and **network set ups**, to **training** and **evaluation** support, we pride ourselves on bringing a personal service to experienced and novice technicians alike, across all industry sectors. Our clients challenge us to develop and apply **thermographic solutions** for every application you can think of, from non-destructive testing to paper processing, or consumer appliance design, to ballistics. But this is what we do best – and it's why industry leader **FLIR** continues to engage us as a distributor.

Please get in touch, arrange for us to visit and we can show you how IR thermography could be your problem-solver.



OVERVIEW: FLIR X8500sc MWIR

Detector Type
FLIR indium antimonide (InSb)

Dynamic Range
14-bit

Accuracy
±2°C or ±2% of reading

NETD
<20 mK

Automatic Gain Control
Manual, Linear, Plateau equalization, ROI, DDE

Spectral Range
3.0 – 5.0 µm /1.5 – 5.0 µm

Size [L x W x H] without Lens & Handle
249mm x 158mm x 147mm
(9.8" x 6.2" x 5.8")

Weight (without Lens & with Handle)
6.35 kg (14 lbs)

The basics

We never like to assume what our clients may or may not know about **infrared (IR) thermal imaging** – so we'll start with the basics. Feel free to skip ahead if you need to.

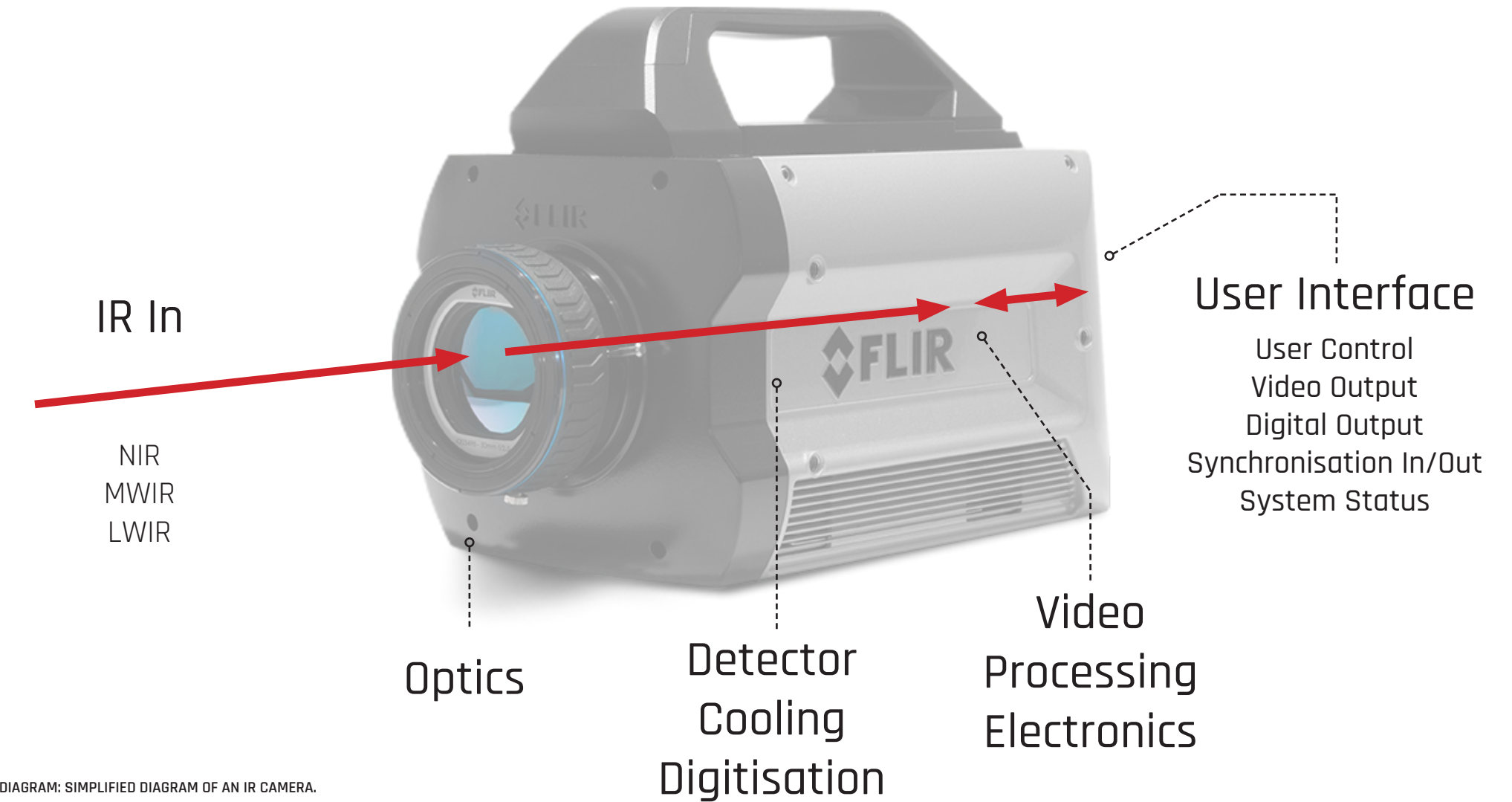
The concept of IR thermal imaging or thermography is very simple: We can see light, but we can't see radiation, or heat. This is because our vision is limited to a very small portion of the electromagnetic spectrum.

Thermal imaging is the process of converting that infrared radiation into visible images, enabling us to see and measure the thermal energy which is being emitted. To explain in a little more detail, unlike visible light, in the infrared world everything with a temperature above absolute zero emits heat. Even very cold objects, like ice cubes, emit infrared.

The higher the object's temperature, the greater the IR radiation emitted. An infrared camera is a non-contact device, similar in construction to a video camera. It produces images of invisible infrared or 'heat' radiation by detecting the energy being emitted and converting it into an electronic signal. This is then processed to produce a thermal image or video, which enables us to precisely examine materials or component parts of a given subject.

Nearly everything gets hot before it fails, which is why IR cameras are an extremely popular, cost-effective, valuable diagnostic tool in many applications.

And as we look at ways to improve manufacturing efficiencies, manage energy, improve product quality and enhance worker safety, the capabilities and opportunities for infrared cameras are on the increase.





Building your camera package



OVERVIEW: FLIR A6260sc

Detector Type
Indium Gallium Arsenide (InGaAs)

Dynamic Range
14-bit

Accuracy
±1°C or ±1% of reading

NETD
NA

Automatic Gain Control
Manual, Linear, Plateau equalization, DOE

Spectral Range
0.9 – 1.7 µm

Size [L x W x H] without Lens
216mm x 102mm x 109mm
(8.5" x 4.0" x 4.3")

Weight (without Lens & with Handle)
2.3 kg (5 lbs)

Building your camera package

The IR camera you choose has to be **fit for purpose**, but how do you know which one is right for your specific application when there are so many to choose from? By working with us, we'll take you through a **simple process** to ensure we find **exactly** the right camera package to **suit your requirements**.



You and your camera

The first and most important part of your camera selection process is for us to fully understand what you need a camera to do. We'll start by talking to you about your specific requirements, either over the phone or in person, before exploring some more detailed discussion points.



Temperature measurement

IR cameras are generally used to measure the temperature changes of a particular object. By knowing the temperature range of that object and the temperature resolution you want to achieve, we can narrow down which types of infrared cameras would suit you best.

> Temperature range

By this we mean how hot or how cold your project will become in a given setting. For example, an aircraft sitting on a runway might have a body temperature of 25°C and an engine temperature of 500°C – so you need an IR camera which can measure from 25°C to 500°C at the same time.

> Temperature resolution

This is sometimes called temperature sensitivity, or Noise Equivalent Delta Temperature (NETD), and is the smallest temperature difference you need to be able to measure. IR camera sensitivities can range from 0.020°C to 0.075°C, depending on the camera's detector type.

FLIR Camera Model	Detector Type	Thermal Sensitivity/NETD	Temperature Range
A655sc	Microbolometer	<30mK	-40°C to 650°C (-40°F to 1202°F) Optional Range: Up to 2000°C
A6751sc MWIR	Indium antimonide (InSb)	<18mK	-20°C to 350°C (-4°F to 662°F) Optional Range: Up to 1500°C,2000°C, or 3000°C
X6901sc LWIR	Strained Layer Superlattice (SLS)	<40mK	-20°C to 650°C (-4°F to 1202°F) Optional Range: Up to 1500°C,2000°C, or 3000°C

TABLE: TEMPERATURE RANGE AND RESOLUTION OF COMMON IR CAMERAS.



Data capture speed

Data capture speeds can vary enormously - we need to consider exposure times, frame rates and total recording time to ensure your camera is capable of capturing the right data.

> Exposure time

Referred to as its 'integration time', this is how quickly an IR camera can capture a single frame of data. The shorter the exposure time, the less likely there is to be any blurring, however the image may be under-exposed. For longer exposure times, more heat data can be captured, but if the object is moving, the image may be blurred. Camera selection therefore has to be combined with thermal resolution, considering the required exposure time with the sensitivity of the camera.

FLIR Camera Model	Detector Type	Exposure Times	Frame Rate
A655sc	Microbolometer	12 milliseconds	50 Hz
A6751sc MWIR	Indium antimonide (InSb)	1.0 milliseconds	125 Hz
X6901sc LWIR	Strained Layer Superlattice (SLS)	0.2 milliseconds	1000 Hz

> Frame Rate

This means how many thermal images you can capture, per second. IR cameras with fast frame rates allow you to capture the thermal signatures of fast-moving targets. Shorter exposure times allow for faster frame rates and overall frame rates can vary from a few frames per second, to thousands of frames per second.

> Total record time

You might want to capture data at high speed for long periods, at high speed for short bursts, or at slow rates for hours. There are plenty of data recording options available and we'll work through these with you as part of your selection process.

TABLE: FRAME RATES AND EXPOSURE TIMES OF COMMON IR CAMERAS.

Building your camera package continued...

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Lens selection

To get the best thermal imagery and most points of measurement for your specific project, you need a lens which fills your field of view with exactly what you need to see – and provides the best spatial resolution to ensure you capture even the smallest of details.

> Spatial resolution

Also known as the Instantaneous Field of View or IFOV, this refers to the smallest physical detail you can detect on your target – the smallest area a single camera (detector) pixel covers. The closer you move to an object, the smaller the area a pixel will detect.

> Field of view

Your field of view changes as you look at objects from further away – so you will have fewer pixels on your target when you're imaging from a distance. Ideally, you want your object to fill your field of view, but sometimes this isn't possible if your subject is particularly hot, or poses danger.

When we know what you want your spatial resolution and field of view to be, we can help you choose the right lens, or set of lenses to capture the data you need.

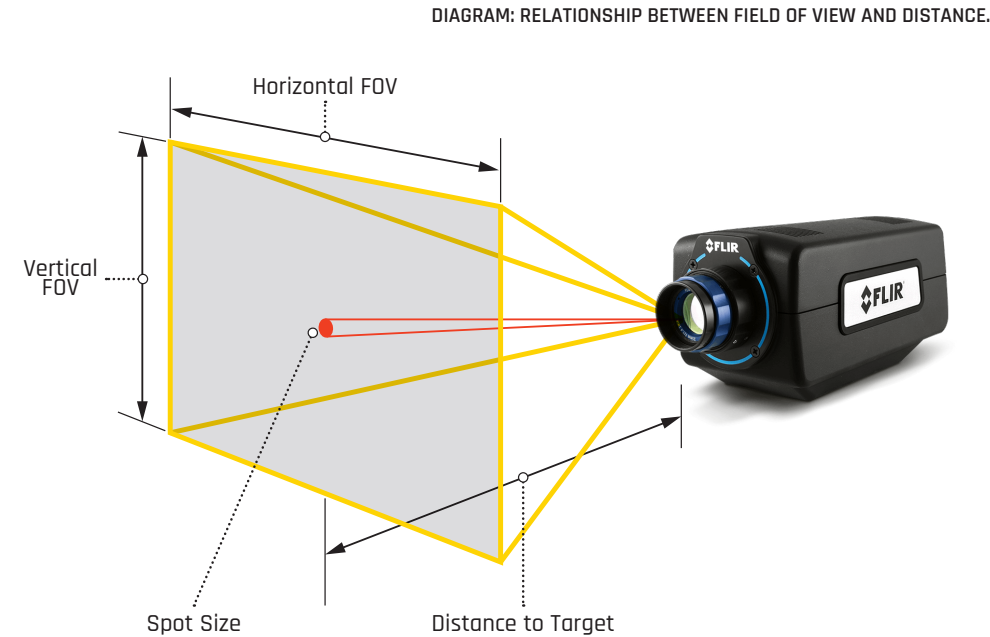


DIAGRAM: RELATIONSHIP BETWEEN FIELD OF VIEW AND DISTANCE.

The **SPOT SIZE** represents what a single detector (pixel) element will see at a given distance.

The **IFOV** is the solid angle subtended by a single pixel of the imaging system. It varies by camera FPA dimensions and lens combination.

SPOT SIZE = IFOV x Distance to Target

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Detector selection

Different detectors sense infrared energy in different wavelengths or wavebands. So, depending on your application, the waveband over which your IR camera senses energy can have a significant impact on your measurement results.

For example, if you need your camera to measure the filament of a lightbulb, you need a detector which operates within the transmission window of the light bulb's glass. Use the wrong detector and you'll simply capture data for the glass instead of the filament.

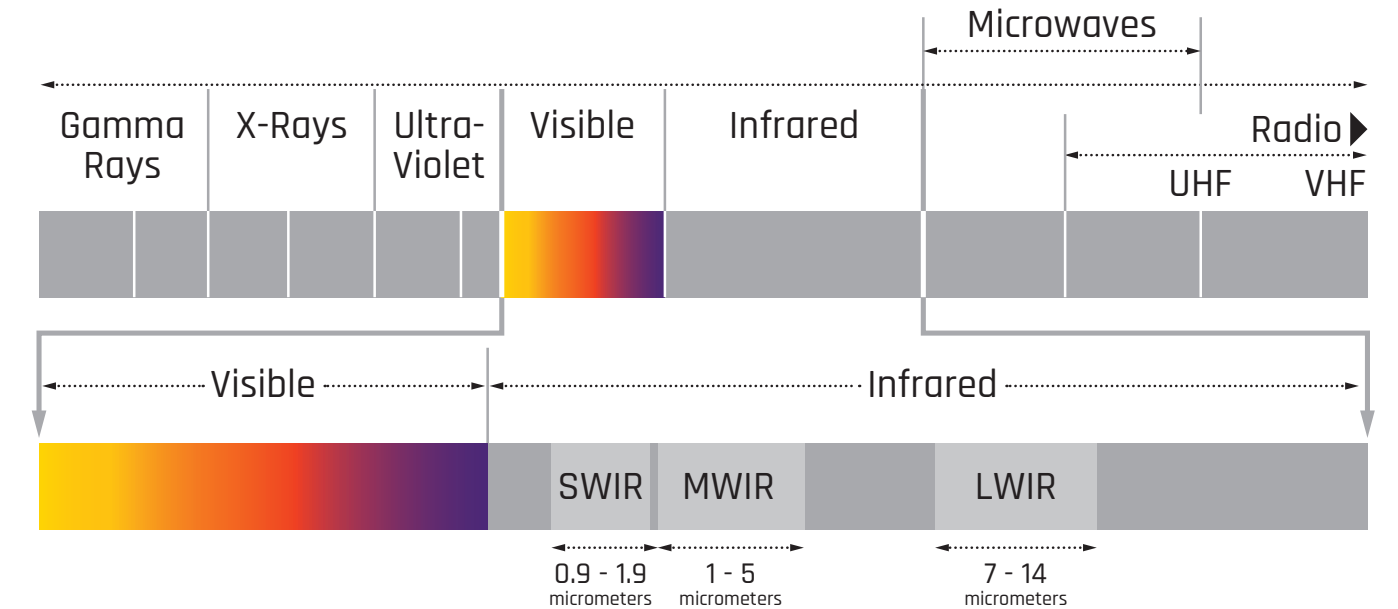


FIGURE: ATMOSPHERIC TRANSMISSION FOR INFRARED ENERGY.

Building your camera package continued...

6

Data Reporting

Camera hardware and data collection is only half the story, our expert team can also help you find the best way of analysing and reporting data.

> Data analysis

Just by looking at an IR image you can quickly see areas of hot and cold, but by applying techniques for image enhancement, emissivity adjustment or image subtraction, you can gain a detailed understanding of the thermal changes taking place on a target object.

Image enhancement for example, allows you to draw out subtle temperature differences. Or removing a baseline image from an energised image allows you to expose extremely small temperature variances.

It's likely you'll also need to share your data with others, so having an IR software package which allows data export may also be important.

> Superframing

This involves cycling the IR camera through up to four unique temperature ranges and sequentially capturing data from each range. By using software such as FLIR ResearchIR Max you can present this data as movie files.

Superframing only works with certain cameras and software though – and we would consider this as part of your selection process.



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Accessories

From protective enclosures to infrared windows, we can advise on the right kit to use with your camera, tailored to the environment it will be operating in.

For mounting your camera outdoors or in manufacturing environments, you may want to consider an enclosure with a special infrared window which is optimised for your specific camera and detector.

Another common accessory is a cable extension for use where your camera is located a long distance away. We can explore options with you for transmitting your thermal data at full frame rates, for miles if necessary.

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Support, training and warranty

Finally, from learning how to switch your camera on, to bespoke measurement techniques, we can provide as much or as little support as you need.

Warranty packages can be tailored to extend from the standard one year to five, or to provide 24hr swap out options for production line applications, where downtime is critical.

Connections

There are many ways in which you can connect your camera for data capture and transfer. The image shown here uses the X6900sc as an example, though user manuals specific to each camera would provide information relevant to individual products.

1. Power switch: This illuminates when camera power is 'On'.

2. Solid State Drive (SSD): Your camera may be supplied with a suitable SSD, formatted to provide the best possible data transfer.

3. Status lights: These help you understand how the camera is operating. The 'Cold' light tells you when the camera has reached its operating temperature.

4. Gigabit Ethernet: This is for connecting with your PC and can be used for data acquisition and/or camera control.

5. MicroSD: Not currently available.

6. USB client: This is a Command and Control port for user interface – it can also be used for firmware upgrades provided by FLIR.

7. HDMI video: This is active when HD video mode is selected. It's compatible with standard HDMI cables.

8. Power interface: An AC-DC power convertor will be supplied with your camera. Guidance will be provided if you choose to use your own DC power supply.

9. Camera Link video output: A standard data interface for high end visible and IR cameras.

10. Auxiliary connector: This provides access to a range of alternative input and output signals.

11. Record trigger: This allows the camera to use an external signal to start recording. The LED will flash when the recorder is ready.

12. CoaXPress video output: This is a standard interface for high speed digital video data and can support flexible image sizes and frame rates.

13. Sync in: This can be selected for the camera to operate as an external Frame Sync to clock frames.

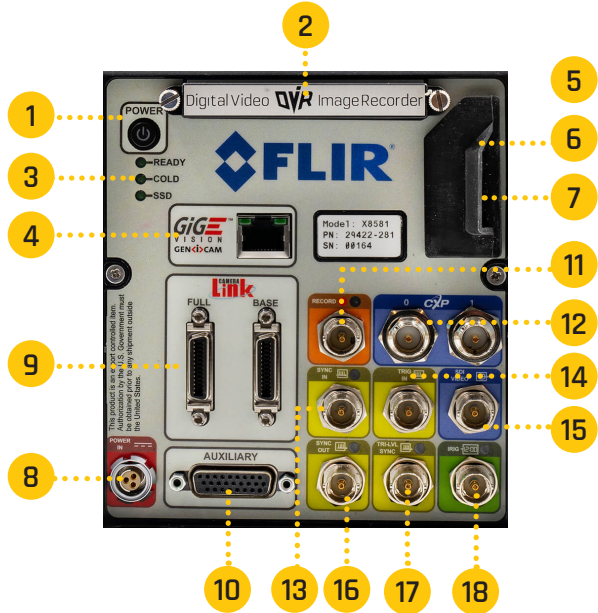
14. HD-SDI: This is a standard HD video interface which can transmit either 1080p or 720p video over distances up to 300ft.

15. Composite video output: BNC connector point.

16. Sync out: This works together with 'Sync in' and can be used to synchronise other events when the camera is in 'Free Run' mode.

17. Genlock input: This allows the camera to synchronise the active video output, to an external video signal.

18. IRIG input: An IRIG-B decoder is built in to the camera to allow for the time stamping of each frame.

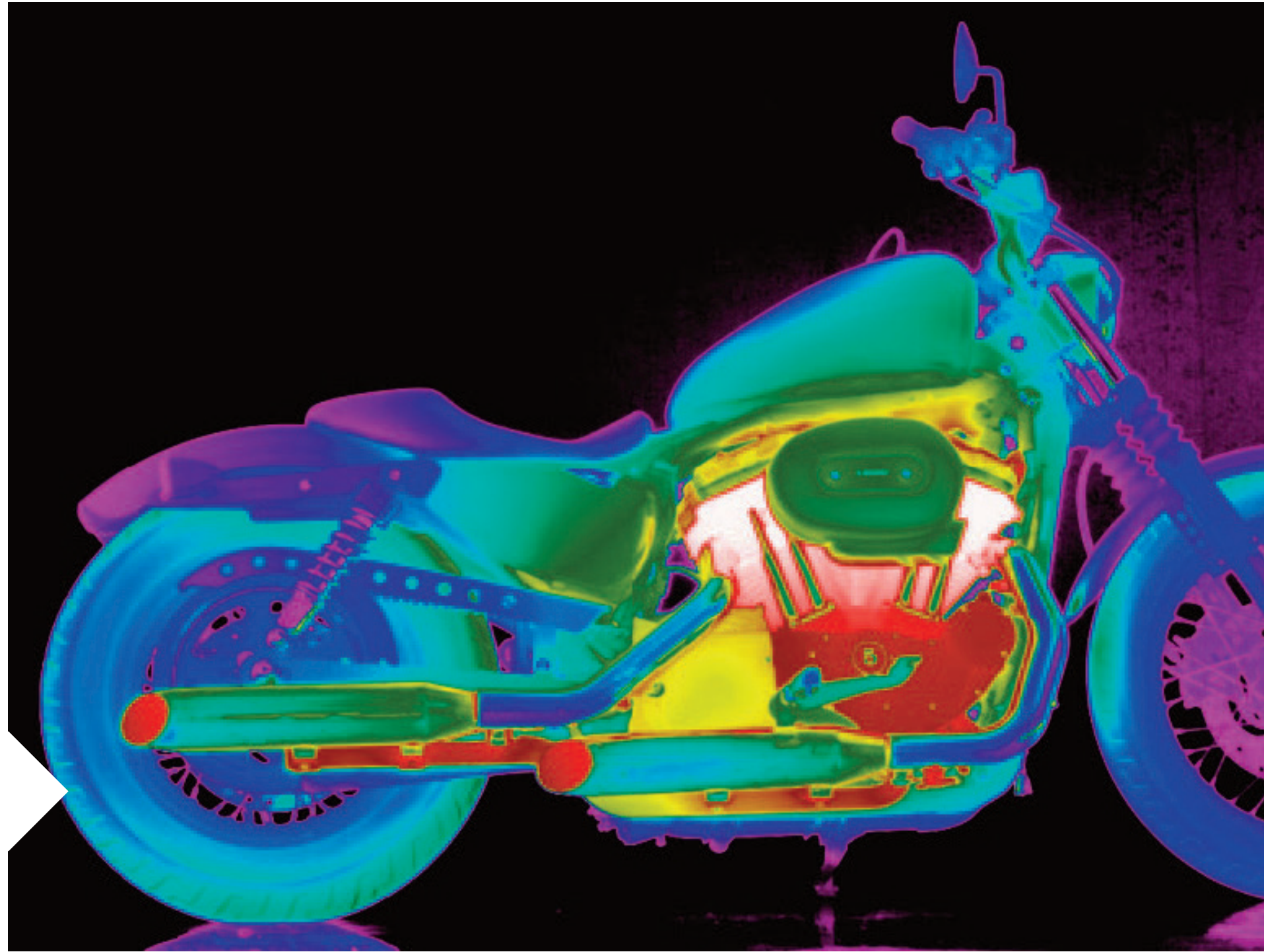


Accessories

X-Series Filter Wheels	
ND 1.0	
ND 2.0	
ND 3.0	
ID07 MWIR - Standard MWIR, 3.0 - 5.0 μm, MWIR imaging	
ID10 Thru Glass - Inspections through glass	
ID11 Glass Surface - Makes glass surface opaque	
ID12 Flame - Inspections through flame	
ID15 Plastic - Makes some thin film plastics opaque	
ID16 CO ₂ - Imaging CO ₂ band	
ID17 Nitrous-Oxide - Imaging CO ₂ band	
ID18 COS - Flame imaging	
ID23 Thru Glass HT	
ID24 Glass Surface HT	
ID25 Flame Surface HT	
X-Series Filter Wheels Blank Filter Holder	
(XX = 40-58 filter IDs reserved for custom cal and camera recognition) (X69XX, X68XX, X85XX)	

We offer a wide range of accessories from HD tripods to Pan & Tilt systems. Most cameras we supply are built to your bespoke requirements and we'll provide advice on the most suitable hardware to suit your system.





Using thermal imaging technology



OVERVIEW: FLIR A6700sc Series

Detector Type
FLIR Indium Antimonide (InSb)

Dynamic Range
14-bit

Accuracy
±2°C or ±2% of reading

NETD
<18 mK

Spectral Range
3.0 - 5.0 µm or 1.0 - 5.0 µm

Size [L x W x H] without Lens
216mm x 102mm x 109mm
(8.5" x 4.0" x 4.3")

Weight (without Lens & with Handle)
2.3 kg (5 lbs)

Using thermal imaging technology

FLIR's **world-leading** R&D camera range combines high performance thermal imaging and precise temperature measurement, with **powerful tools** and **software** for **analysing** and **reporting**.

Their cameras can distinguish temperature changes as subtle as 0.02°C, provide precise measurements from -80°C to +3000°C, and feature state-of-the-art detector technology. These are just some of the reasons why FLIR is typically the first choice for R&D professionals.



Research & Development

Thermal imaging has proven itself to be an indispensable analysis method in the R&D community – its application possibilities are seemingly endless.



Printed circuit boards

Understanding heat dissipation within a circuit board is extremely difficult, but thermal imaging makes this possible without compromising performance.



Thermal imaging microscopy

When a thermal imaging camera is combined with a microscope, it becomes a thermal imaging microscope. Using this technology, temperature measurements can be taken from subjects as small as 3 microns.



Medical thermography

FLIR cameras are widely used in medical diagnostics and treatment. They provide an accurate, measurable, non-contact technique which can capture changes in surface temperatures.



High-speed/stop motion

With cameras capable of microsecond exposure times capturing more than 62,000 frames per second, FLIR is at the cutting edge of high-speed camera technology. Its pioneering applications of high-speed thermography include analysis of jet engine turbine blades, supersonic projectiles and explosions.



Laser designation

Laser designators emit a beam of laser energy which is used to mark a specific place or object. Thermal imaging cameras can detect these otherwise invisible laser beams and are used for identifying locations and targets.



Thermal signatures

Commonly used in the design of vehicles, sensors and camouflage systems, thermal signatures measure infrared brightness and can reveal the appearance of a given object.



Infrared Non-Destructive Testing (IR NDT)

IR NDT can identify internal issues by studying thermal differences on a target surface. It's a valuable tool for detecting voids, delaminations and trapped water in composite materials.



Tracking

Thermal imaging camera systems can be used to work alongside video tracking systems to help maintain visibility and track a specific object when working in low light conditions.



Technical surveillance and countermeasures

Thermal imaging is used to identify heat signatures from covert surveillance devices. Even devices hidden within objects can be revealed by the minute energy given off in the form of IR energy.



Directed energy

Directed Energy Weapons (DEW) include laser, high power radio frequency and particle beam technologies. Thermal imaging cameras are used in the testing of DEW instrumentation and the analysis of target impacts.



Short Wave Infrared (SWIR)

This is used in the non-destructive quantitative analysis of crops, pharmaceuticals and agricultural products. It's also used to examine art forgeries.

Case study #1 high speed thermal cameras

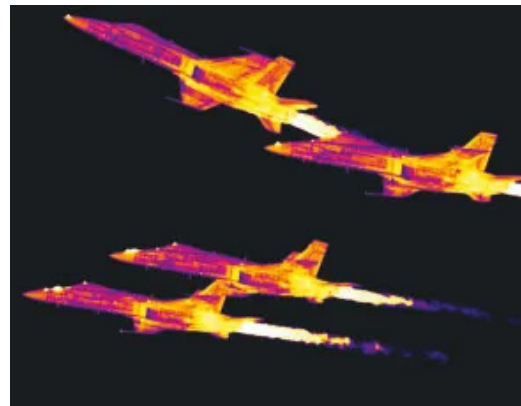
The Challenge

Measuring heat with thermocouples or spot pyrometers can leave you with an incomplete picture of a device's thermal properties. These traditional methods don't offer the resolution or speed needed to fully characterise high speed thermal applications. Infrared cameras, on the other hand, capture thousands of points of high speed thermal measurement, showing you exactly where heat is flaring up, and how fast. With the right infrared camera, you can gather reliable measurements and generate compelling data for your research.

In general, there are two types of thermal infrared cameras in use today. These are high performance cooled photon-counting cameras and low cost uncooled microbolometer-based cameras. In general, it doesn't make sense to run microbolometers faster than about 30 frames/sec.

The Solution

The majority of thermographic cooled cameras on the market today use a detector made from Indium Antimonide (InSb). Typical integration times for -20°C to 350°C objects with a FLIR InSb camera range from about 6 ms to 50 μ s depending on the camera model. These really short integration times make it possible to "stop motion" and make it possible to accurately measure very fast transients.



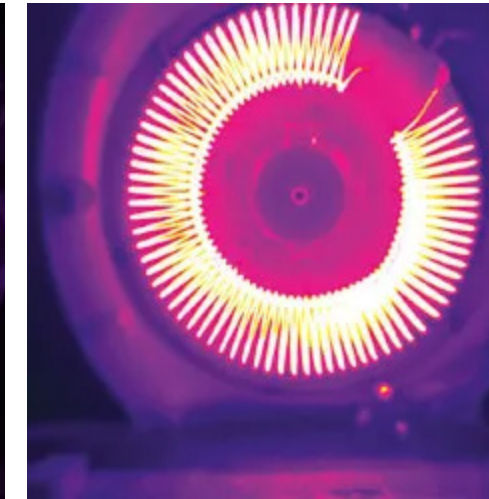
The Result

Let's take a look at a printing process that is required to heat a sheet of paper up to 60°C. The paper is coming out of rollers at 50 inches/second and must be uniform in temperature across both the width and length. Both a cooled photon counting camera and a microbolometer camera were used to capture side by side data.

The data from the microbolometer shows a big, relatively steady bump in temperature along the length. The data from the photon counting camera shows significant variations in temperature over time. This one graph was enough to convince the R&D engineer of two things – a photon counting camera was required for testing the product and that a PID control system must be implemented on the heated roller instead of the simple bang-bang controller if the desired design objectives were to be met.



Photon counting detector camera
(66 μ s integration time)



Microbolometer detector camera
(8 ms time constant)

For the second example, we are looking at blades on a fast rotating fan and trying to stop motion on the blades in order to accurately measure temperature of them. Note how the fast integration time offered by the cooled camera stopped the motion of the blade, allowing for accurate measurement of the blade surface as well as the heating coils. In contrast, the blades are moving too fast to be recorded by the uncooled camera.

The Right Tool For The Job

As you can see, it's important to use the correct thermal detector for the job. For tests with fast thermal transients or frame rate requirements, it's usually best to select a higher performance cooled photon counting camera. If, however, high frame rates aren't required, then an uncooled, microbolometer camera can be a cost-saver.

Case study #2 long-range target tracking



A high-resolution thermal camera was essential for this type of application. A thermal camera does not only allow us to see targets in dark or adverse weather conditions, like cloudy weather or rain, but we were also looking for a high-speed, high-resolution thermal imaging solution that enabled us to see smaller objects at very long range.

Davide Piras, System Engineer, Nurjana Technologies

The Challenge

Based in Cagliari (Italy), Nurjana Technologies provides mission-critical engineering services and system integration for the aerospace and defence industries. The company has been successful in offering unique electro-optical systems for government test labs and military test range applications.

The latest addition to the company's product portfolio is the NEOS (Nurjana Electro-Optical System), a complete hardware- and software-based system for realtime optical tracking in long-range, high-precision measurement applications. Near-realtime data fusion and computer vision are leveraged for detecting and tracking targets in the most demanding scenarios.

The Solution

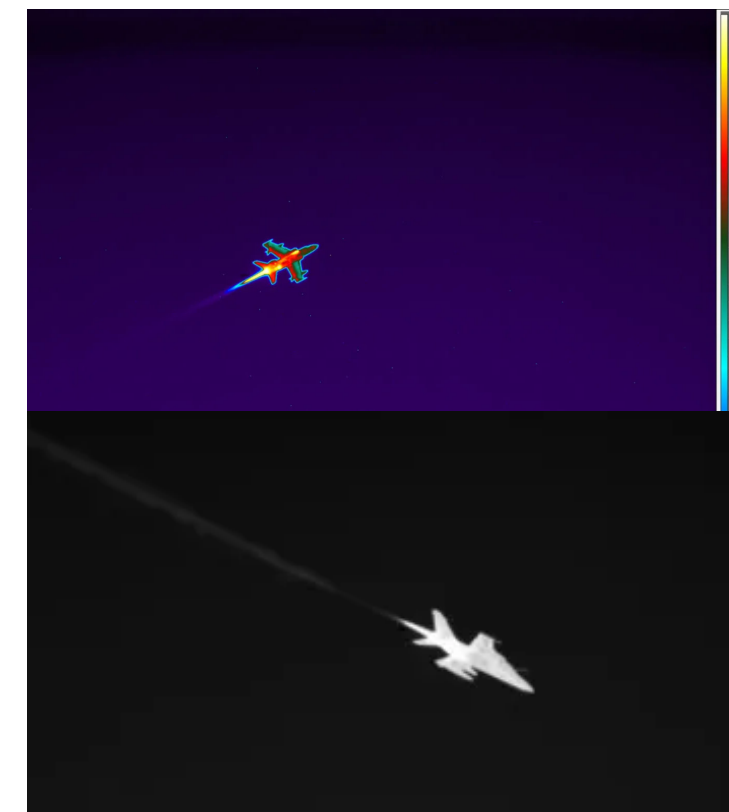
The company was already familiar with Teledyne FLIR thermal imaging cameras and based on the team's previous experiences on test ranges all over the world, it was a natural decision to involve FLIR in the development of the NEOS product as well. The FLIR RS8500 high-speed MWIR camera proved to be the best solution for the application.

"We looked extensively at different camera types, but the image quality, high-speed features, and many different integration and connection options of the FLIR RS8500 made it the ideal solution to improve target visibility within NEOS," Piras explains.

The Result

Nurjana Technologies demonstrated the NEOS system and FLIR RS8500 at select firing test range facilities and centres of excellence for experimentation in the NATO domain. The demonstrations not only showed the FLIR camera's impressive clarity and image quality but also its superiority to visual cameras in cloudy conditions.

"Thanks to the FLIR camera, we were able to overcome adverse weather conditions, improve target visibility with a clear identification of the target's thermal signature, and see the target in almost any weather condition," says Piras. "We are glad to have the chance to integrate such an extremely powerful camera into our solution."



Demonstrations with the FLIR RS8500 showed the camera's impressive clarity and image quality.

Test Range Applications

The NEOS system with the integrated FLIR camera is customisable and available for a wide range of automatic detection, recognition, identification and tracking applications, including bomb scoring, splash detection, impact point prediction, and accurate missile, projectile and rocket tracking. A downsized version of NEOS is available for civilian applications within the domains of critical infrastructure protection and monitoring.

Case study #3 science on the racing track



“”

Before, we really had no visual information about the efficiency of our products, until we used this thermal imaging camera.

Pete Davis, Founder, Hot Products Engineering

The Challenge

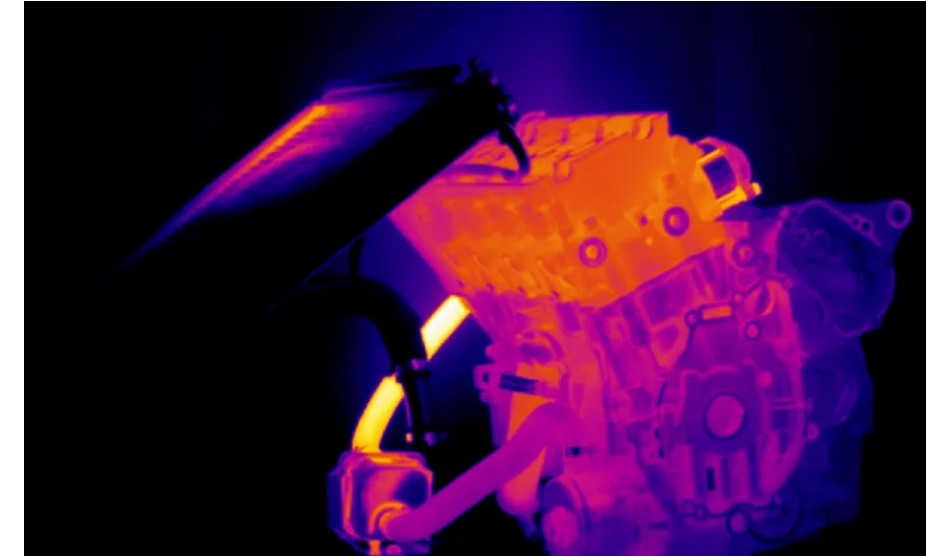
Engine pre-heating systems are becoming an ever more valuable asset and even a competitive advantage on today's car racing tracks. Hot Products Engineering, a US manufacturer of engine pre-heaters, puts a lot of effort into spreading the gospel about engine pre-heating. The company now also uses thermal images taken by a FLIR camera to show the value of its engine pre-heating products.

Warming up the engine is one of the essential rituals every motor racer performs before getting on the track. Until recently, for many racing disciplines (kart, drag racing, etc.) this ritual just meant starting the engine cold and revving it. Race car engines will only achieve peak power at a very specific temperature.

The Solution

In a test set-up along a drag racing track, a FLIR SC6700 was used to capture the result of a Hot Head DragPro competition Engine Heater. The thermal imagery produced by the FLIR SC6700 clearly shows how the temperature quietly builds and maintains exactly between 135°F and 210°F.

Thanks to his background and experience with the National Laboratory, the founder of Hot Products Engineering, Pete Davis, is no stranger to the power of thermal imaging: "I have used thermal imaging cameras before to study thermal patterns in a research and development context, so I knew that these cameras can see things that aren't visible to the naked eye."



A thermal image of a pre-heater heating a 600cc racing engine.



The thermal image of heat building in engine.

The Result

"We are constantly developing new markets for our engine pre-heating systems and so we need to educate our customers all the time about the value of our products. Thermal imaging is a great help for this, and we rely heavily on the images that we have captured with the FLIR SC6700," Pete Davis continues.

"The FLIR SC6700 thermal images present the heat build-up of the engine in great detail," says Pete Davis. "The FLIR camera is very advanced, but still easy enough to use and it reveals its info very swiftly to the user."

Case study #4 NDT/materials testing

Seeing Inside Materials

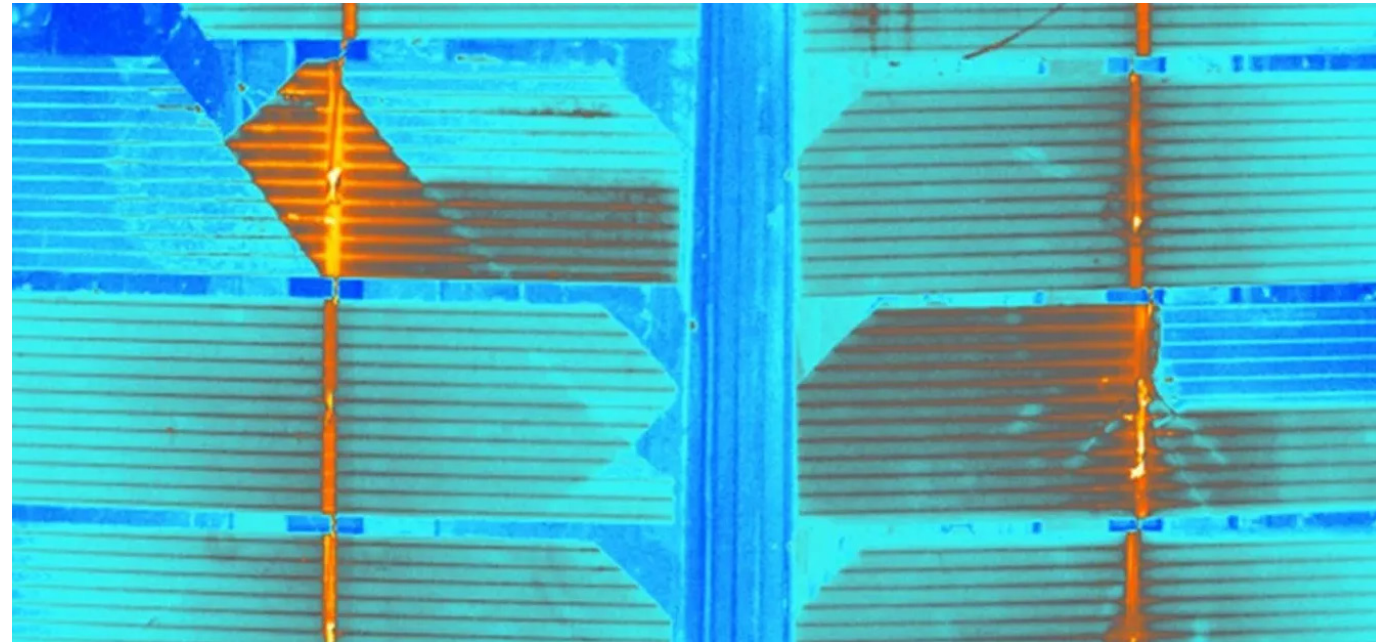
FLIR cameras with Lock-In, Transient, and Pulse capability can perform advanced inspections such as Non-Destructive Testing (NDT) or stress mapping, resolving temperature differences as low as 1 mK. NDT is widely used to evaluate the properties of a material, component, or system without causing damage.

IR cameras can detect internal defects through target excitation and the observation of thermal differences on a target's surface. Thermal imaging is a valuable tool for detecting defects and points of failure in composites, solar cells, bridges, and electronics. It is also a great tool for thermal mapping of stress when performing materials testing.

Solar Cell Inspection

Solar cells may have electrical shunt defects. When the cell is energised, these shunts can be detected easily with Lock-In thermography. Lock-In photoluminescence testing can be done with near-infrared cameras.

Camera: FLIR A6750 MWIR • High-performance InSb

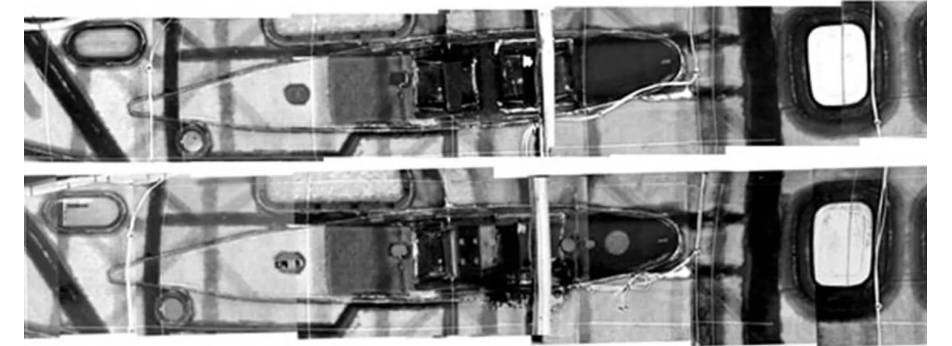


Shunt defects in solar cells, revealed with Lock-In thermography.

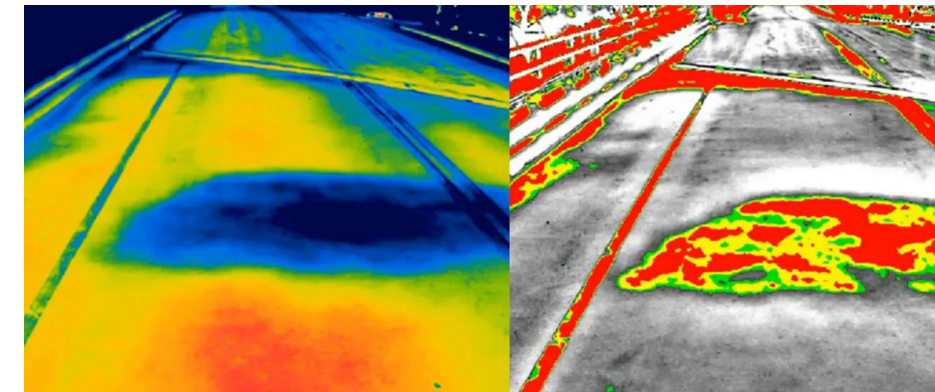
Composite Inspection

Thermal non-destructive testing can detect internal defects through target excitation and the observation of thermal differences on a target surface. It is a valuable tool for detecting voids, delaminations, and water inclusion in composites.

Camera: FLIR A6750 SLS • Longwave infrared



Thermal NDT reveals the internal structure of a composite panel.



Areas of deterioration stand out clearly on the concrete deck.

Bridge Deck Inspection

Bridge deck inspection is a non-destructive multi-sensor technique that identifies areas of deterioration and calculates a quantitative index to determine the degree of deterioration for each span/lane of the bridge. The FLIR infrared camera provides a more accurate evaluation of the condition of concrete bridge decks. It also helps to better predict the progression of deterioration and assess the need for rehabilitation. By enhancing the early detection of deterioration on the bridge's surface, transportation agencies will be able to apply proactive maintenance actions to extend the remaining life of the deck with lower life-cycle costs.

Camera: FLIR A655sc • High-resolution LWIR

Case study #5 making the invisible visible



How Accessible Thermal Imaging is Transforming University Research and Teaching

At universities today, access to reliable scientific data and professional-grade tools is essential to preparing the next generation of scientists, engineers, and researchers. Thermal imaging helps meet that need by making invisible heat patterns visible and measurable.

The FLIR A40 Research and Development Kit brings that capability into academic environments with research-grade thermal imaging performance, an accessible price point, and scalable licensing through FLIR Research Studio.

Application Story 1: Physics and Astronomy Education

"Thermal cameras are a wonderful tool because they allow us to reveal things that are normally invisible. They help students see concepts that would otherwise remain abstract," says Darren Baskill. By making the invisible visible, thermal imaging changes how students engage with scientific principles. They can observe heat transfer, absorption, and dissipation in real time, turning abstract concepts into practical, memorable experiences.



Darren Baskill, Professor of Astronomy

Application Story 2: Psychology and Life Sciences

Professor Gillian Forrester at the University of Sussex has pioneered the use of thermal imaging in psychological research, applying it to the study of stress and emotional responses in both humans and non-human primates. One compelling example is the identification of the "nasal dip," a measurable temperature change associated with stress responses. As Professor Forrester explains, "Every single participant in the study exhibited a nasal dip, with temperature changes ranging between 2 and 7 degrees Celsius."



Gillian Forrester, Professor of Evolutionary Psychology

Application Story 3: Data Analysis and Measurement

Professor Stephen Wilkins describes this transition clearly: "The image provides the observation, but measurement is what allows us to extract scientific understanding." FLIR's academic licensing model expands software access across entire classes, while Python and MATLAB integration supports advanced analysis and custom workflows.

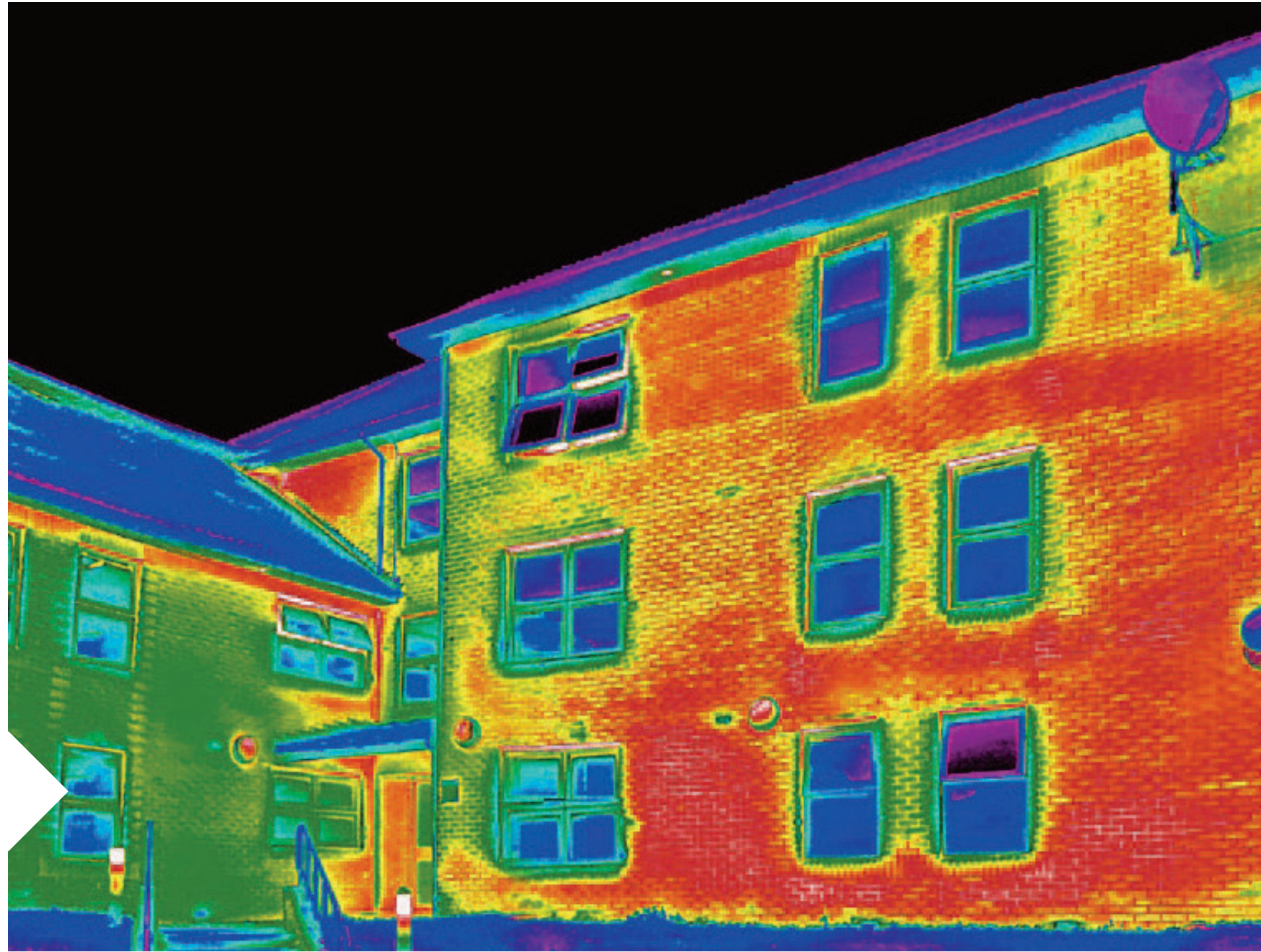


Stephen Wilkins, Professor of Astronomy

Expanding Access, Inspiring Discovery

The FLIR A40 Research and Development Kit enables universities to move beyond limited lab access and extend radiometric imaging and analysis capabilities across departments, classrooms, and research programmes. Students gain hands-on experience with real data, researchers expand the scope of their studies, and institutions create stronger connections between education, research, and real-world application.

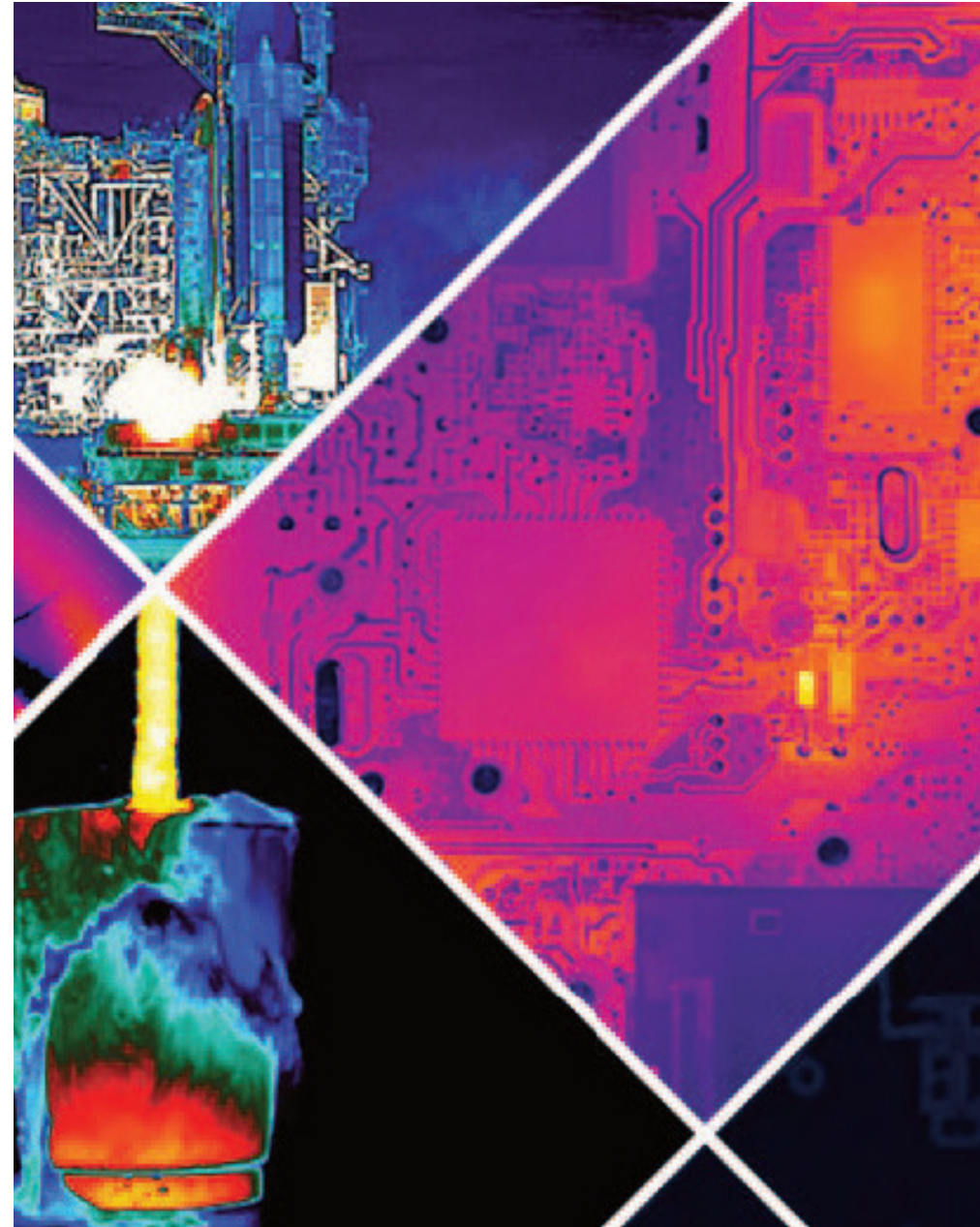
Affordability and ease of deployment are central to this shift. By lowering the barrier to entry, the A40 Kit makes it possible to scale infrared discovery, supporting everything from foundational teaching to advanced cross-disciplinary research.



Cameras and software

Cameras

FLIR's R&D/Science infrared camera solutions offer the sensitivity, spatial resolution, frame speed and integration time needed to capture fast temperature changes, and take pinpoint accurate temperature readings on targets with motion.



Cooled photon detectors

A modern cooled thermal imaging camera has an imaging sensor that is integrated with a cryocooler.

This is a device that lowers the sensor temperature to cryogenic temperatures. This reduction in sensor temperature is necessary to reduce thermally-induced noise to a level below that of the signal from the scene being imaged.

Cooled thermal imaging cameras are the most sensitive type of cameras and can detect the smallest of temperature differences between objects. They can be produced to image in the mid-wave infrared (MWIR) band and the long-wave infrared (LWIR) band of the spectrum where the thermal contrast is high due to blackbody physics.

Thermal contrast is the change in signal for a change in target temperature. The higher the thermal contrast, the easier it is to detect objects against a background that may not be much colder or hotter than the object.



Cooled cameras in FLIR's Research & Science range:

X-Series (high-speed / HD science cameras)

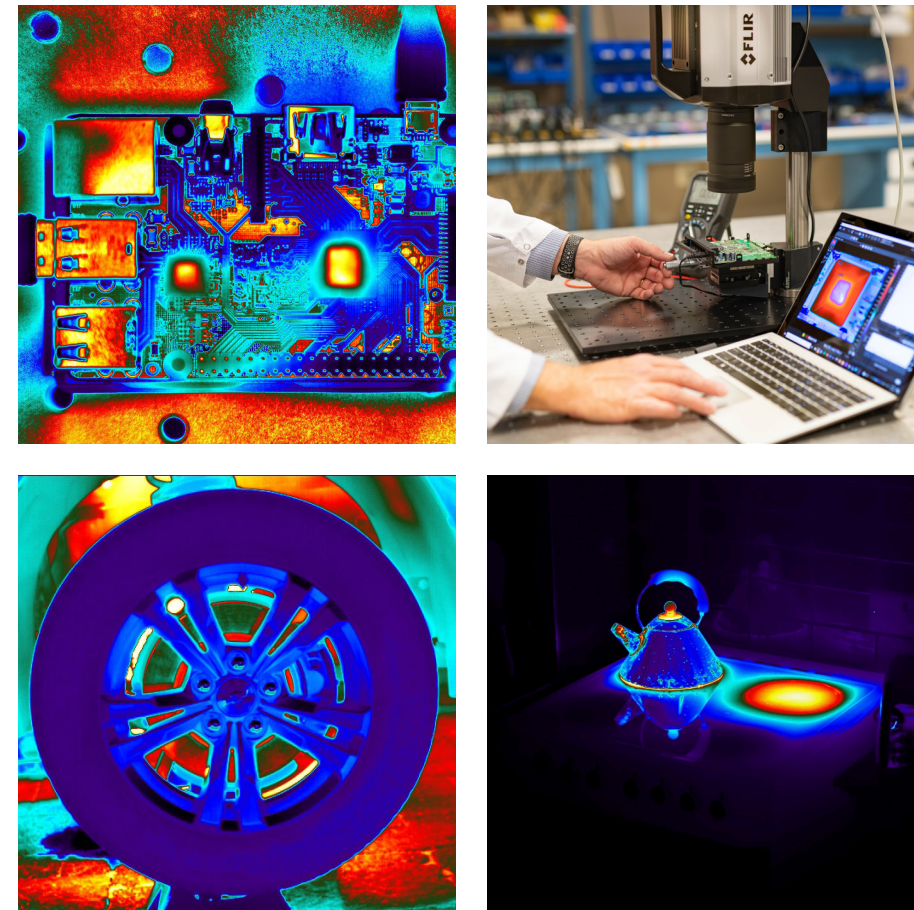
X6980-HS InSb: high-speed MWIR science-grade camera
X6980-HS SLS: high-speed LWIR science-grade camera
X8580-HS InSb: high-definition MWIR science-grade camera
X8580-HS SLS: high-definition LWIR science-grade camera

A-Series (high-performance)

A6700 MWIR: science-grade MWIR InSb camera
A6750 MWIR: high-performance MWIR InSb camera
A6750 SLS: longwave infrared camera
A6780 MWIR: midwave infrared camera
A6780 SLS: longwave infrared camera
A8580 MWIR: compact HD camera
A8580 SLS: compact LWIR HD camera

RS-Series (range science / long-range)

RS6780: range and scientific MWIR camera
RS8480: HD MWIR range science camera for long-range radiometric measurement
RS8513-HS InSb: high-speed MWIR camera for range and science applications



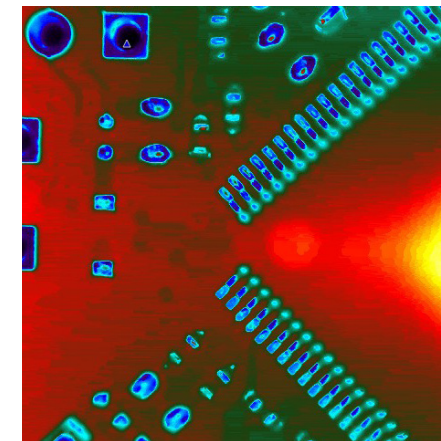
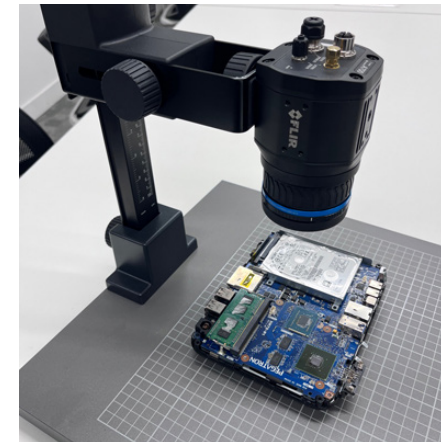
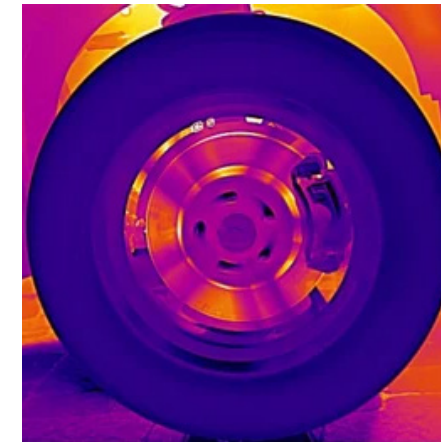
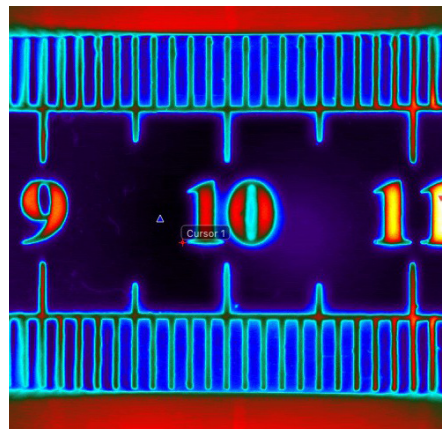
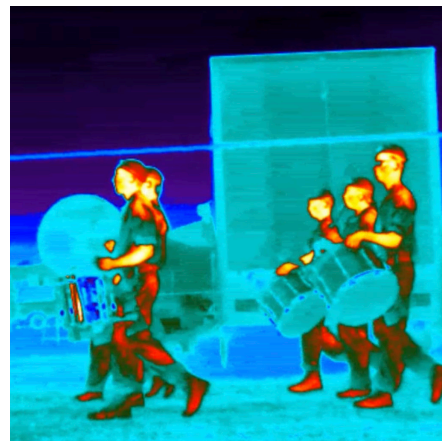
Uncooled microbolometer detectors

An uncooled thermal imaging camera doesn't need a cryocooler. It uses a microbolometer detector instead, which is a grid of tiny pixels, typically made from vanadium oxide. Each pixel's electrical resistance changes as it heats up or cools down, and the camera measures that change to build a thermal image.

Without a cryocooler, uncooled cameras are smaller, lighter and lower in cost than cooled systems, and they use less power. They also need less maintenance. A cooled camera's cryocooler eventually wears out and needs replacing after around 10,000–13,000 hours of use.

The trade-off is speed and sensitivity. Uncooled cameras capture images more slowly, so fast-moving objects can appear blurred. A spinning tyre, for example, can look as though its spokes are transparent. They are also less sensitive: a typical uncooled camera resolves around 50 mK, compared with around 20 mK for a cooled camera.

For tests with fast thermal transients or high frame rate requirements, a cooled camera is usually the best choice. But where high frame rates aren't needed, an uncooled microbolometer camera can be a highly capable and cost-effective option.



Uncooled cameras in FLIR's Research & Science range:

A-Series (fixed-mount science cameras)

A655sc: high-resolution science-grade LWIR camera
A-Series Science Kits (A400 / A700): fixed-mount science kits

Research & Development Kits

A40, A50 and A70 Research & Development Kits:
fixed-mount thermal cameras

T-Series (handheld science cameras)

T1020 (Science): HD performance handheld infrared camera
T865 (Science): high-performance handheld infrared camera
T840: high-performance thermal camera with viewfinder
T560 (Science): thermal camera for science applications
T540 (Science): thermal camera for science applications
T530 (Science): thermal camera for science applications



FLIR Research Studio

Analysis software that works the way you work

FLIR Research Studio provides users with a quick and efficient way to display, record, analyse, and report accurate thermal data. With a streamlined, intuitive GUI and unique feature set, users at all levels can effortlessly record and evaluate thermal data from multiple FLIR cameras and recorded sources simultaneously.

User-friendly, intuitive set up and control

- Set up quickly with plug-and-play camera connection
- Begin analysis immediately with streamlined workflow
- Hand off projects when needed thanks to easy-to-learn instructions
- Runs on most preferred platforms: Windows, macOS, Linux
- Available in 22 languages



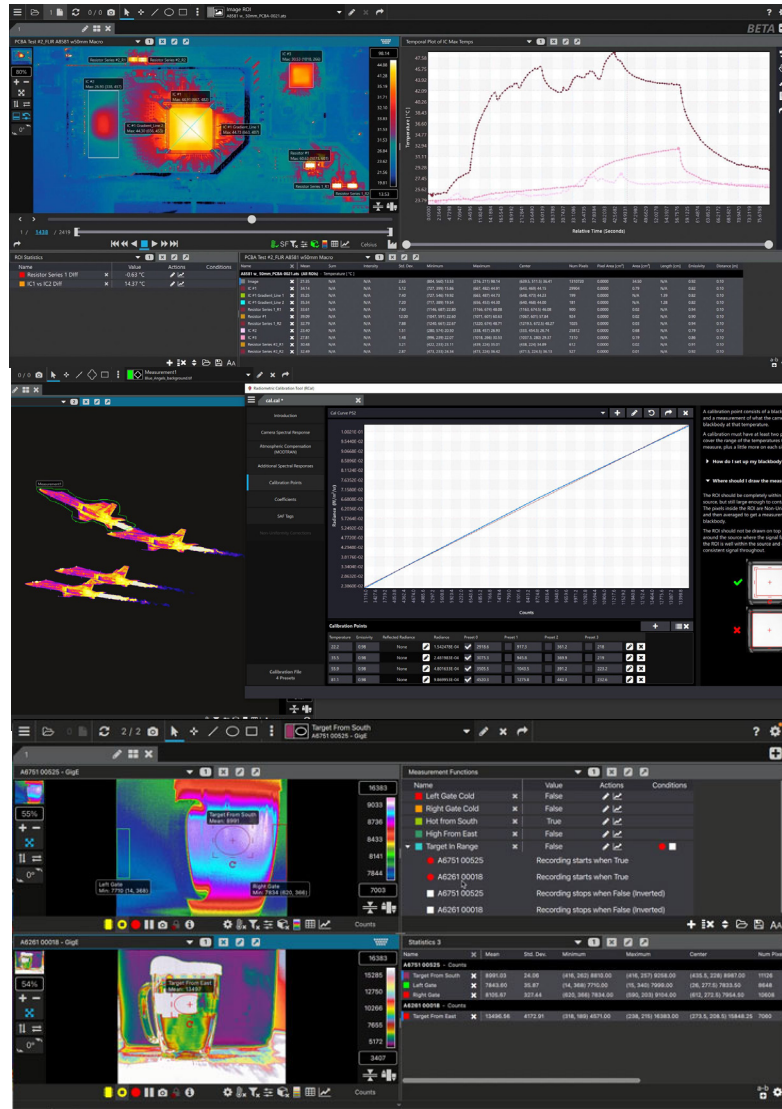
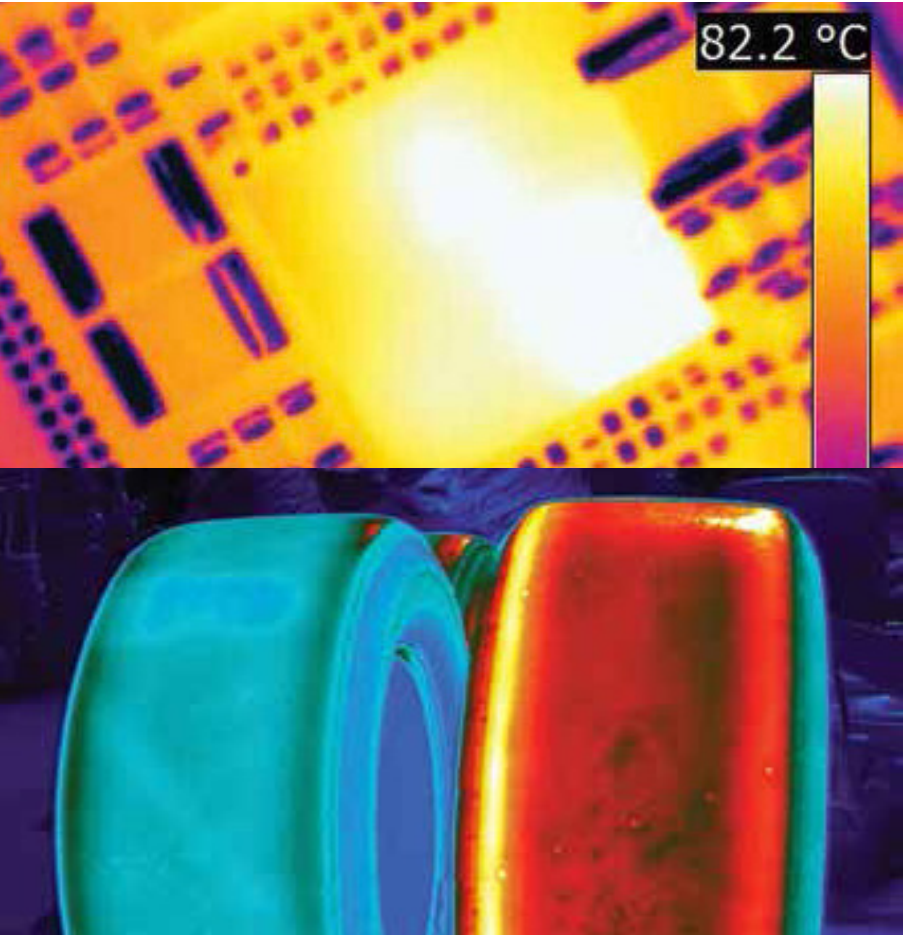
Feature-rich analysis tools

- Perform thermal measurements on objects of any shape or size
- Analyse data with line profile and time-versus-temperature plots
- Generate both types of plots simultaneously from multiple connected cameras and recorded data
- Better understand thermal impact and drift with the help of Frame Subtraction
- Share data and reduce analysis time during repeat events using workspaces
- Review and recall files using the quick-collect strip

FLIR Research Studio continued...

Workflow

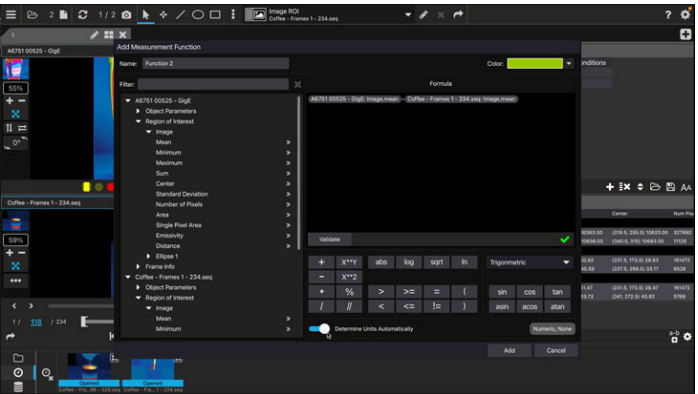
1. Control connected cameras
2. Thermally tune the image
Select palettes
Adjust level/span
Target regions with digital zoom
3. Record data
Take single image snapshots or infrared movie sequences
4. Playback & Analyse Data
ROIs – Spot, Line, Box, Circle
Analysis – Statistics Table, Line Profile, Temporal Plot
5. Export Data to 3rd-party formats
CSV and JPG/PNG/BMP/TIFF files and MPEG4 videos
6. Share data
Save and recall workspaces
View images and movies in the free player application



Calculate emissivity based on a known temperature and then apply the updated emissivity

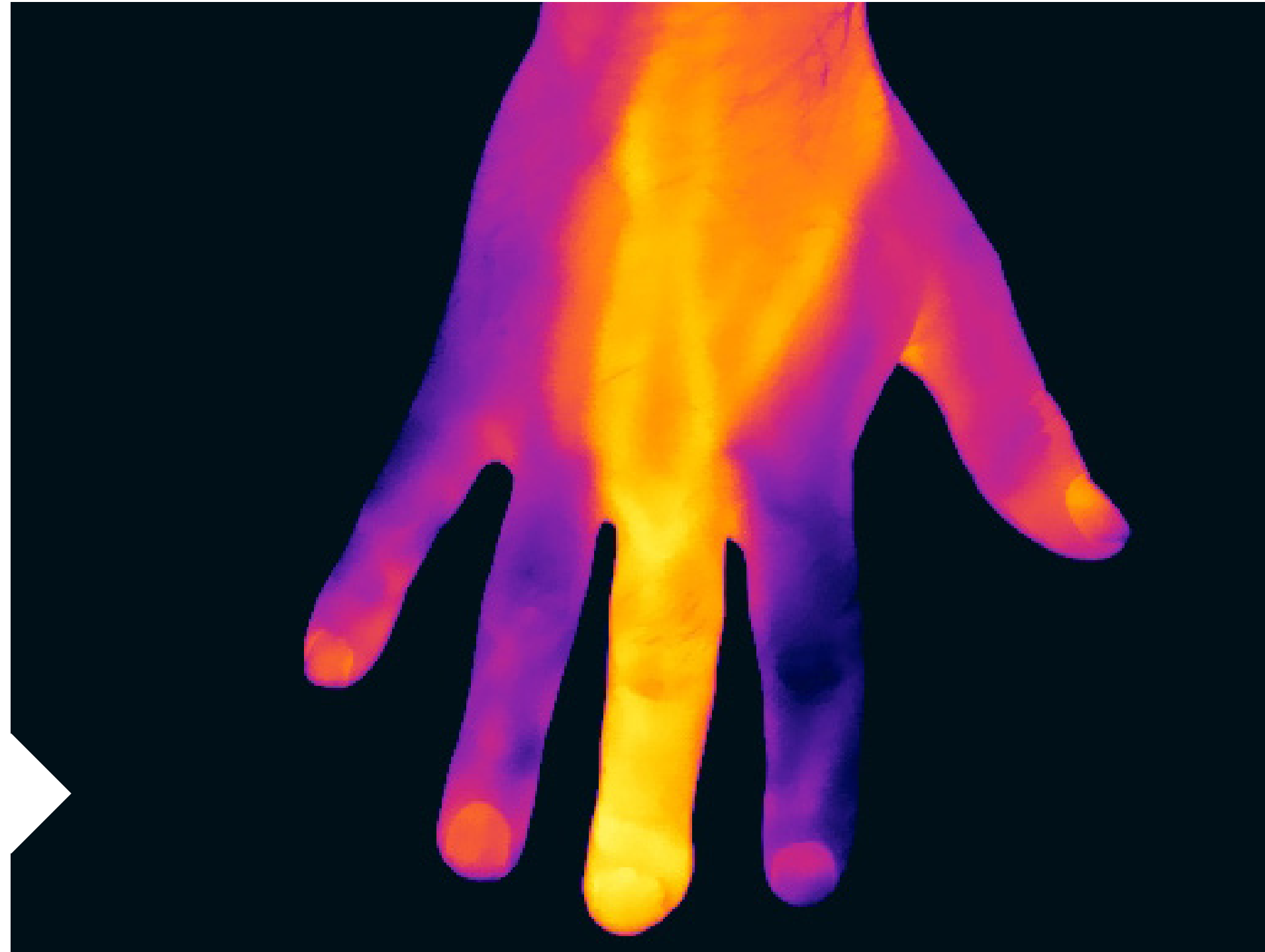
Create custom user calibrations and non-uniformity corrections with the user calibration tool.

Trigger recordings based on regions of interest using the measurement functions module.



Pull data from multiple cameras, recordings, or images to create a custom analysis using the measurement functions module

FLIR Research Studio is available as a 1-year, 3-year, or 5-year subscription in Standard Edition or Professional Edition. The Professional Edition offers an expanded set of analysis tools and features to help streamline recording, analysis, and export processes. With a Professional Edition license of Research Studio, you can optimise your data capture with custom user calibration support and share data more conveniently than ever using the free Research Studio Player application.

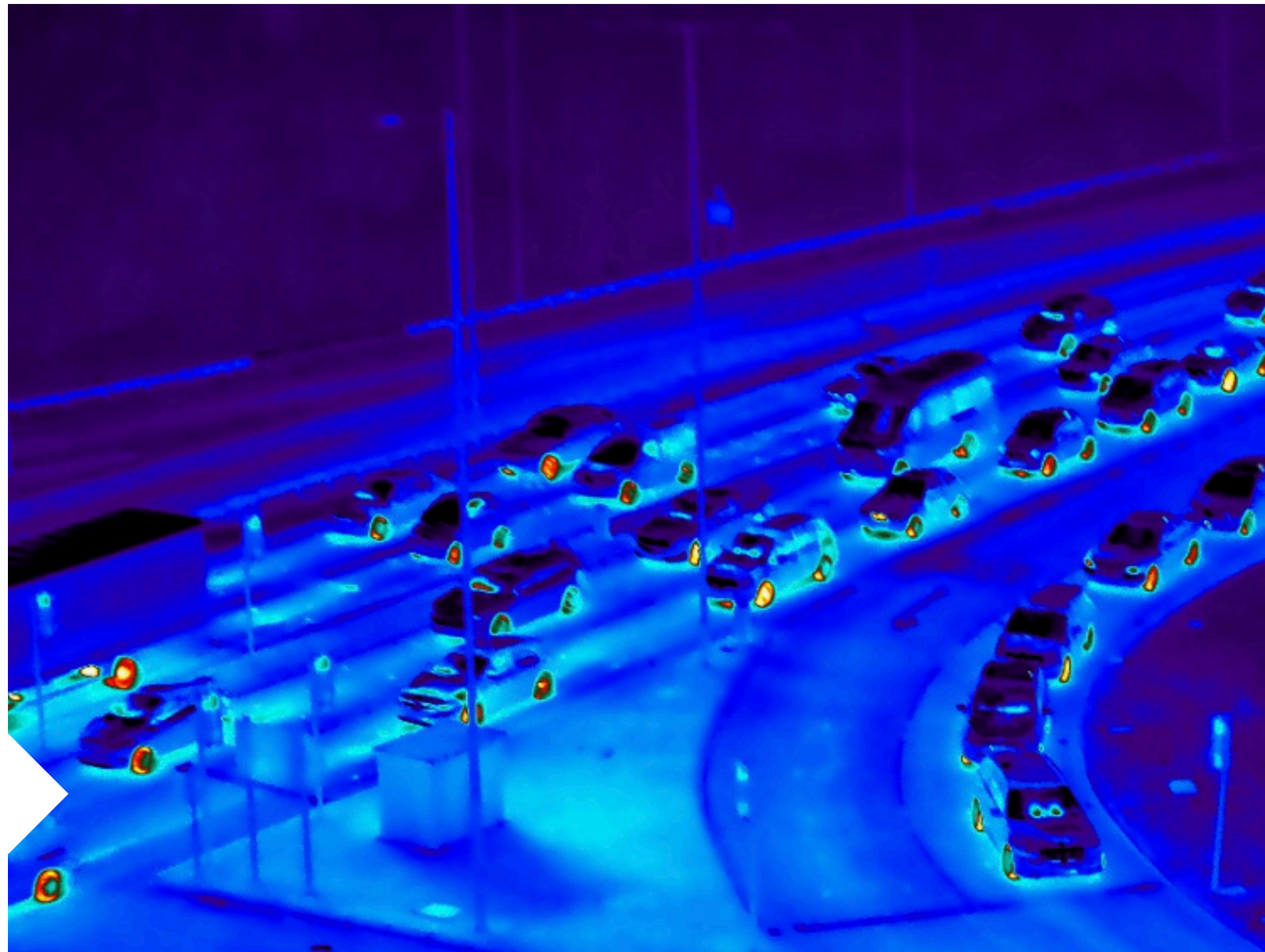


Service & support

We understand your FLIR camera is essential for your work. And, in the same way you couldn't work without your laptop or phone, if you have an issue with your camera, you need it back up and running as quickly as possible.

Prevention is always better than cure which is why FLIR recommends investing in one of its tailored maintenance packages. These include a 14-point inspection and calibration programme:

1. A complete operational check
2. Calibration of MSX and laser alignment
3. Checking of all internal cables and PCB connections
4. Cleaning the viewfinder and checking the optics
5. Upgrading internal camera software with the latest versions
6. Performing minor repairs
7. Verifying/re-equalising the temperature ranges
8. Verifying the standard lens calibration
9. Verifying the ambient temperature compensation
10. Recalibrating the camera to meet factory specifications
11. Calibrating temperature ranges up to 1,500°C if appropriate
12. Performing quality-approved acceptance test procedures
13. Providing calibration labelling with the next maintenance date
14. Providing a calibration certificate



Who we work with



Thermal Vision Research has amassed many years of experience in the capabilities of the ever-changing portfolio of FLIR infrared cameras as they are used in the research and scientific markets. By accessing this, we are able to quickly specify the instrumentation and support packages our projects need and know there is knowledgeable back up available.

Cailean Forrester
Managing Director
Inspectahire



We consider TVR a valuable partner to our research. We acknowledge that without Matthew's repeated visits to the University and his valuable comments, suggestions and constructive criticism, we wouldn't have obtained the quality data needed for our research.

John Karadelis
Senior Lecturer in Computational Mechanics
Coventry University



Matthew has worked with us over the past six years to address a number of thermal imaging requirements for various applications spanning R&D as well as designing thermal imaging technology into custom products. His familiarity with the FLIR product range and experience of applying thermal imaging techniques in a research and development environment has been invaluable in helping us select the best suited products to meet our requirements. The on-site demonstrations and short term rentals have also given us absolute confidence, that we've selected both the right product and the right supplier. We thoroughly value Matthew's expertise and focus on problem solving rather than box shifting. I would highly recommend others to seek out his services for any thermal imaging applications.

Chris Deighton
Engineering Manager
Carillon Ltd





AUTHORISED
SCIENCE PARTNER



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in Matthew Clavey

Thermal Vision
 *Research*

The logo graphic for Thermal Vision Research, featuring a horizontal bar with a color gradient from dark purple on the left to bright yellow on the right.