



APPLICATION STORY

FLIR Tau core in Unmanned Aerial Vehicles: the thermal eye in the sky

At the term Unmanned Aerial Vehicle – or UAV in short – most people will immediately think of the military version, but UAV's are not only used for warfare. The German UAV manufacturer Coptersale.de provides UAV's for commercial use with the Tau thermal imaging camera from FLIR.

The Tau is compact, lightweight and its extremely low energy consumption makes it a perfect UAV component, according to Johannes Thor from Coptersale.de. "There really isn't a good alternative on the market that can compare with the Tau if you look at size, weight, energy consumption and imaging performance."

Coptersale.de consists of two people: Johannes Thor and Peter Plischka. "Peter is the one that designs the copter frames. He is a real copter enthusiast and he's constantly making new designs."

Johannes Thor arrived at the copter building industry indirectly. "I started as a sound and vision engineer. I have produced some documentaries for the German broadcaster WDR, registered concerts at the Rockpalast and made some company videos."

Unhappy with crashing copter

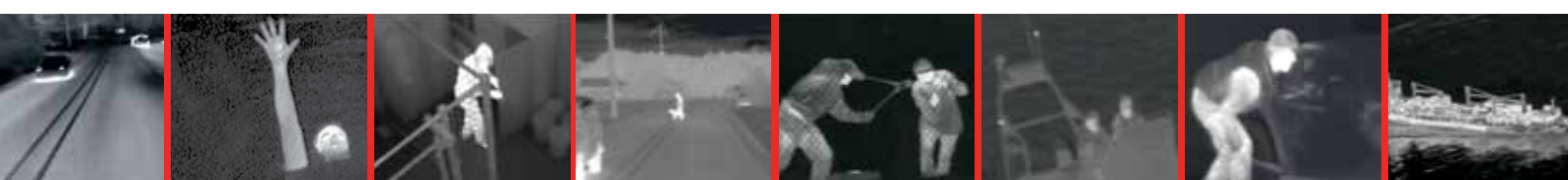
"When I was working on a company video I needed an aerial shot and I found that the best solution was a hexacopter, a UAV that has six rotors. That's how I found out about these copters", continues Thor. "At first I ordered one from an existing company, but I wasn't pleased with it. It crashed during its third flight. So I started fiddling with these copters, making some homebrew versions."

"After a while I started to get into the copter building scene and got in touch with Peter Plischka. We decided to start producing and selling copters for aerial video productions. We tried to make them easier to use, better and cheaper than the existing ones."

The low energy consumption of the small and lightweight Tau thermal imaging camera makes it a perfect UAV component.

With the remote control unit the pilot can control all of the hexacopter's movements.

The thermal images are sent through a wireless video down-link to the transflective TFT monitor supplied by Coptersale.de.



Johannes Thor from Coptersale.de

'It just works'

And Thor's company is not without success. A steady flow of orders is coming in. Thor knows exactly what the reason is for that success. "People simply want something that works."

The electronics in the copters from Coptersale.de come from HiSystems GmbH. "We decided not to try to reinvent the wheel and to stick to what we're good at. So Peter Plischka designs the frames, I designed the video mount and together we assemble and calibrate the copters." One of the innovations in their copters is the easy click on click off system that can be used to attach and detach the board computer.

Requests for thermal imaging

Soon, however, Thor realized that visual imaging wasn't enough. "We started receiving requests for a copter with a mounted thermal imaging camera. The first request came from a university that wanted to use the copter for insulation inspections and more specifically for the inspections of roof insulation with a thermal imaging camera. The second request came from a search and rescue society in Ireland. They wanted to be able to find missing persons in the woods. When we received those requests we knew that we were on to something."

Peter Plischka is responsible for the copter frame design at Coptersale.de.

The FLIR Tau thermal imaging camera high sensitivity and built in state of the art image processing software ensure that the smallest of details are made visible in the crisp 640 x 480 pixels thermal image.

Thermal imaging sees in total darkness

Thermal imaging cameras like the FLIR Tau, do not need any light whatsoever to produce a crisp image on which the smallest of details can be seen. But they are not only useful in total darkness. They can provide valuable information during daylight as well. Thermal contrast is extremely difficult to mask. This means that people trying to hide or to camouflage themselves will clearly show up on a thermal image.

Unlike CCTV cameras, thermal imaging cameras are also not blinded by glare from the sun. They can also see through light fog and smoke and in practically all weather conditions.

All this makes them extremely useful for security and surveillance, seeing through smoke during a fire, finding missing persons and other, sometimes life saving, applications.

FLIR Tau: perfect for integration in UAV's

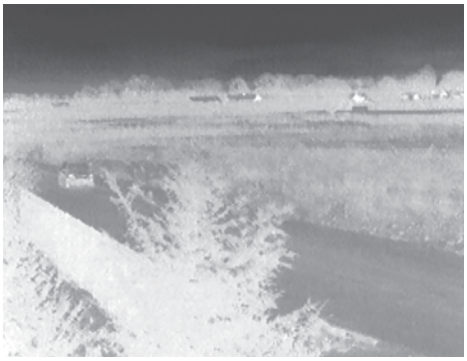
That sent Thor on a search for a good thermal imaging camera that was small, light and didn't consume a lot of power. He found the FLIR Tau thermal imaging core. According to Thor the choice for the Tau camera was an obvious one. "The Tau is by far the smallest and lightest thermal imaging camera on the market and it has remarkably low power consumption. It consumes less than one Watt and that's negligible if you compare it to the power consumption by the copter's engines of about 350 Watt."

Tau thermal imaging core: a perfect UAV component

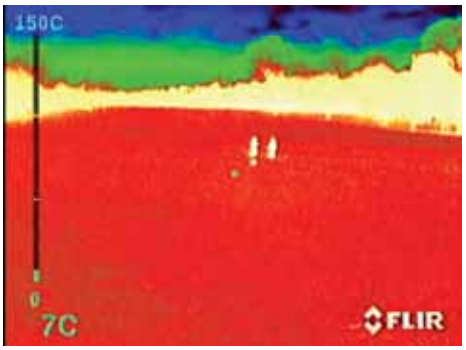
The FLIR Tau thermal imaging core contains a maintenance free, uncooled Vanadium Oxide (VOx) focal plane array (FPA) that produces crisp thermal images with a resolution of either 320 x 256 or 640 x 512 pixels, which can be displayed on any monitor that accepts composite video. Thor supplies his clients with both of the FLIR Tau resolution versions. The FLIR Tau thermal imaging core used in the test flight described in this article had a resolution of 320 x 256 pixels.

Both resolution versions of the FLIR Tau thermal imaging core are highly sensitive to small temperature variations, allowing

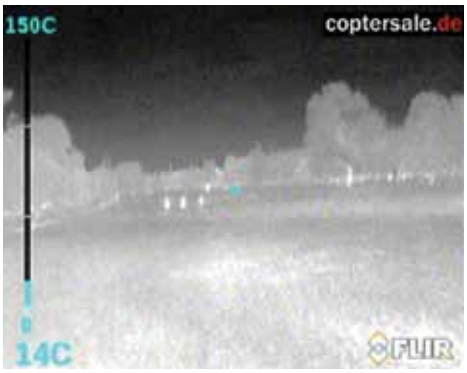
A man stepping out of a car as seen by a 640 x 480 FLIR Tau thermal imaging camera. The hexacopter is hovering at a height of 9 meters and at a distance of approximately 54 meters.



A car seen from the hexacopter at a distance of approximately 256 meters, using a 640 x 480 FLIR Tau thermal imaging camera.



This rainbow colored thermal image of two people and a dog was taken by a 320 x 240 pixels Tau at a distance of about 80 meters.



This white hot thermal image of three people was taken by a 320 x 240 pixels Tau at a distance of about 100 meters.

them to visualize temperature differences of 50 mK. The exact size of the FLIR Tau thermal imaging camera is 44.5 x 44.5 x 30.0 mm, it weighs 72 grams and it has a power consumption of 900 milliWatt. This combination makes it a perfect UAV component, according to Thor. "The Tau thermal imaging camera's light weight and low power consumption allow longer flight times, so if you compare it to the other options the FLIR Tau thermal imaging camera is the only realistic candidate."

Plug and play

Furthermore the Tau is also extremely easy to integrate. "When we replaced the visual camera with the thermal imaging camera I was surprised at how easy it was. It really was plug and play for the Tau thermal imaging camera behaves exactly like the visual camera with the same power and video connectors."

To further enhance the image quality of the FLIR Tau thermal imaging core it has a built in advanced Digital Detail Enhancement (DDE) video processing algorithm. This is a sharpening filter which aids in making edges and other image details more distinct in both night and daytime conditions. And according to Thor it works perfectly. "The

Due to the Tau thermal imaging camera core this UAV can be very effectively used to search for missing persons, even at night.

Tau can visualize minute temperature differences. The smallest of details can be seen on the thermal image. As you can see on the thermal image taken during a test flight in the park, every single leaf of grass can be seen."

Optimal lens choice

The Tau core comes with a wide variation of optional lenses that will suit every possible application. "If you're integrating a thermal imaging camera in a UAV then you need to find the right balance between long range and a wide enough field of view to be able to navigate. But you also have to take the vibration into account, for if you have a narrow field of view the vibrations of the copter will be visible on the thermal image. So I advise my clients to choose the 19 mm lens for the 320 x 240 version of the Tau. If they opt for the 640 x 480 version of the Tau then I'd say the 13 mm lens is the best. In my opinion that lens gives the Tau the optimal performance."

Coptersale.de offers two copters: a hexacopter (with six rotors) and an octocopter (with eight rotors). According to Thor the hexacopter is the most popular one. "The hexacopter is a little bit less stable, than the octocopter, but the octocopter has about 20% less flight time, because it is heavier and contains more electromotors. With the same payload, let's say a FLIR Tau thermal imaging camera, a hexacopter will fly for about 15 minutes, while an octocopter will fly about 12 minutes."

Easy to pilot

Both copters are relatively easy to pilot, according to Thor. "Unlike helicopters that require constant correction to keep under control, our copters will automatically balance out if no commands are given. Combined with the GPS location and the reading from the altitude meter this allows the copter to hover in the air at the same location, automatically correcting wind movement."

To that end there are three gyrosensors and three acceleration sensors incorporated in the board computer, one of both for each axis.

If the copter receives no information from the controller it will use the information from the elevation meter and GPS system to hover in the same location.

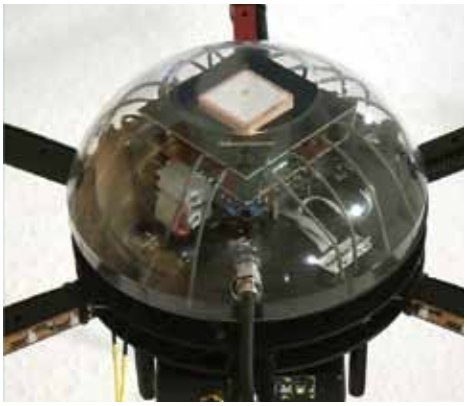
APPLICATION STORY

Compact, light weight and easy to integrate, the FLIR TAU is the perfect thermal imaging camera to integrate in any Unmanned Aerial Vehicle.

Letting go of the controls

"Our copter requires no manual corrections at all to hover on the same location. Using GPS location data and the built in altitude meter the copter will hang still in the air, hovering on the spot, as soon as if the controller lets go of the controls. And with one touch on the home button it will come back to the location of lift-off."

Coptersale.de delivers both hexacopters (with six rotors) and octocopters (with eight rotors).



Both copters of Coptersale.de have the same board computer with built in GPS, altitude meter, gyrosensors and acceleration sensors to enable semi-autonomous flight.

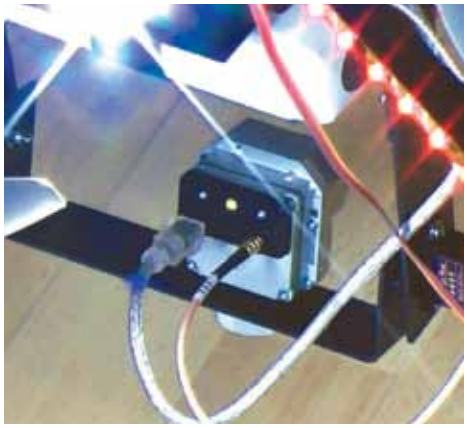
Care free mode

"There is also included what we call a care free mode", explains Thor. "Without the care free mode enabled, pointing left and right with the controller corresponds to the copter's left and right. But that can be quite confusing for the operator; for the copter's left can be the operator's right, if you know what I mean", explains Thor.

"With the care free mode enabled the board computer combines the information from the GPS location and the digital compass to ensure that pointing left on the controller corresponds to the operator's left instead of the copter's left, making the copter more easy to pilot from a distance for new users."

Search grid

For search and rescue operations the copters can also follow a search grid. "The copter uses the GPS location to pause at previously determined waypoints. This feature makes our copters especially useful for tracking down people that have gotten lost or injured."



Installing the FLIR Tau thermal imaging camera on the UAV's from Coptersale.de was very easy, according to Thor. "It really was a matter of plug and play."

With the addition of the FLIR Tau thermal camera the copters of Coptersale.de are finding new clients. "Recently the local police have also voiced their interest in our copters with thermal imaging camera."

Positioning the thermal imaging camera exactly where you want it

Other applications might include roof insulation inspection and solar panel inspections. "Getting the right viewing angle for these applications is difficult, but with one of our copters the thermal imaging camera can be positioned exactly where you want, hovering completely still, to obtain the perfect viewing angle."

"The Tau thermal imaging camera really is the perfect addition to the onboard equipment of our copters. It adds significantly to the functionality with a minimal impact on flying time", concludes Thor.

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

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