



## APPLICATION STORY



# FLIR Tau core helps to identify anomalies in solar plants

*Tau is a compact, lightweight thermal imaging core. It is the perfect component to mount underneath Unmanned Aerial Vehicles (UAV's), also called drones. Just one application is the inspection of photovoltaic (PV) cells in solar plants. According to Antonio D'Argenio from Panoptes srl "There really is no alternative on the market that compares with Tau. If you look at imaging performance, size, weight and energy consumption Tau is the perfect tool to mount underneath a UAV."*

Panoptes Srl is located in Palermo, Italy. The company's ownership is divided by four people and two firms (viz. Antonio D'Argenio, Andrea Borruso, Claudia Spinnato, Mario Tulone, Easy Integrazione di Sistemi Srl and Idea Srl). Together, they have all the skills for the development of scientific and technical instruments that can be used with lightweight drones.

"The Panoptes project was initiated by our common interest towards geo-information, UAVs and automation", says Antonio D'Argenio, CEO of Panoptes. "We started to work with small drones at the end of 2009 with the purpose to collect aerial geo-data. Drones are radio-controlled aircrafts which can be used in a number of applications instead of traditional manned aerial platforms."

### Unhappy with consumer cameras

"We started using consumer cameras" continues Antonio, "but after a short time we felt the need for cameras and thermal detectors that are especially designed for small drones. Therefore, we designed Panoptes, a family of multi-sensor modules coupled with special software components to be used with small UAVs."

### mT-Panoptes: a specific multi-sensor platform for solar plant inspections

The first multi-sensor that was designed is the so called mini-Thermo (mT). It is a small and compact multi-sensor platform. It is equipped with a thermal imaging camera and a CCTV camera. The mT-Panoptes is especially designed to be mounted underneath UAVs that are inspecting photovoltaic cells in solar plants

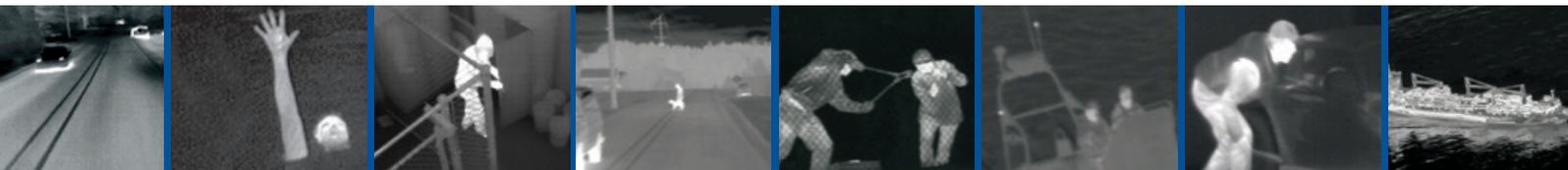


*mT-Panoptes includes a FLIR TAU 640 thermal core and a 720 p video-camera. It comes with a carbon fiber cart which allows mounting underneath small drones.*

### Efficiency of photovoltaic cells in solar plants

In a solar plant, anomalies in photovoltaic cells and modules can cause a reduced efficiency of the entire system. Periodic preventive maintenance inspections are aimed at locating malfunctions.

A fast and easy way to find anomalies in photovoltaic cells is using a thermal





A screenshot of the Solar Inspector running on a Windows 8 tablet PC. The red area on the left corresponds to the image shown on the right.

camera. A thermal imaging camera creates a crisp image based on subtle temperature differences and makes temperature differences visible. Exactly these temperature differences between components can be a serious indication that there are malfunctions

Often thermal inspections are carried out from the ground. Sometimes mobile platforms or helicopters are used. A new and innovative way to inspect photovoltaic cells in solar plants is the use of UAVs.

### mT-Panoptes: an alternative for solar plant inspections

The mT-Panoptes can easily be used for photovoltaic cell inspections in solar plants. During the flights, both thermal and visual high quality video is recorded on board by a two-channel mini DVR. The thermal imaging channel is transmitted in real time to the ground and the thermal data is presented in the dedicated Solar Inspector software.



Thermal images taken from different heights (about 10 m in the left image and 20 m in the right). Hot cells in modules are evidenced by red circles.

The thermal camera is used to find anomalies. The visible camera can be used as a reference against the thermal image. It can help to understand if the thermal anomalies are related to faults in modules or from external factors like shadows.

The mT Panoptes multi-sensor is extremely lightweight and can be used on UAVs with low load capacity (<250 g). It integrates a FLIR Tau thermal imaging core that produces crisp thermal images of 640 x 512 pixels on which the smallest of details can be seen. At the same time it is equipped with an HD (720p) video-camera. The mT-Panoptes can easily be mounted on a small drone that can fly over a solar plant.

### mT-Panoptes: combining unmanned flights with geospatial techniques

"Our Solar Inspector software offers a unique and intuitive environment for both operation in the field and for further analysis afterwards", continues Antonio D'Argenio. "The mT-Panoptes can be bundled with a tablet PC running Windows 8 Pro software. This makes using the Solar Inspector in the field extremely easy.

Collected thermal data are shown in real time. Anomalies and their exact location in the solar plant are shown on a map of the solar plant. Solar Inspector also allows replaying the videos recorded onboard so that data can be reviewed anytime.

"We have chosen FLIR Tau because it is the perfect core to be integrated into the mT-Panoptes", says Antonio D'Argenio. "No thermal imaging core is so compact and lightweight. It also delivers excellent quality thermal images. Tau also has an extremely low power consumption which is important since the mT-Panoptes needs to operate on batteries."

### 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 640 x 512 pixels, which can be displayed on any monitor that accepts composite video.

The FLIR Tau thermal imaging core detects extremely small temperature differences of 50 mK. Its small size (44.5 x 44.5 x 30.0 mm), low weight (72 grams) and low power consumption (900 mW) make it the ideal core for mounting under a UAV for any application.

To further enhance the image quality of FLIR Tau, the thermal imaging core has a built-in advanced Digital Detail Enhancement (DDE) video processing algorithm. This is a sharpening filter which helps in making edges and other image details more distinct in both night and daytime conditions.

### UAVs for solar plant inspections

A lightweight drone equipped with mT-Panoptes multi-sensor platform can perform fast inspections of solar plants. The Solar Inspector proprietary software, provided with mT-Panoptes, can help to recognize anomalies and failures.

Solar Inspector also allows producing a comprehensive inspection report for the customer.

"mT-Panoptes, including a FLIR Tau thermal imaging core, mounted underneath a small UAV is a perfect alternative to traditional inspections."



The combined use of thermal and visible data allows recognizing for example the effect of a shadows. The red square indicates the shadow of a pole in the plant.



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

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