



APPLICATION STORY



Sky-Watch Integrates FLIR Quark™ 640 into Small UAV

Sky-Watch designs and manufactures quad-rotor UAVs for military, law enforcement, security, firefighting, and search and rescue applications. Based in Denmark, Sky-Watch has integrated a FLIR Quark™ 640 longwave infrared thermal sensor into their Huginn X1 drone to give customers a thermal vision option. Originally, the X1 was designed to manage a single payload. But due to Quark's compact size, Sky-Watch has been able to design a dual-payload version that is capable of simultaneously operating a Quark thermal camera core and a visible spectrum camera. Necessity, Mother of Invention.

Finding the Right Thermal Camera Core

Sky-Watch's main customers are within emergency management, which covers fire brigades, police, security, and search and rescue. All of their customers have in common the need to see at night so they can find missing or camouflaged people. Night vision cameras were too bulky for their platform. "Besides," Michael Messerschmidt, Sky-Watch Business Development Manager, said, "for base protection and compound protection, if you want to see somebody who is sneaking around, thermal is much better."

Sky-Watch scoured the market for the right thermal camera core to use on the X1. They

looked at companies in Germany, the United Kingdom, India, China, and the U.S. All of them claimed to have a small camera core that would suit their needs, yet the smallest was more comparable in size to FLIR Tau®. In fact, Sky-Watch considered using a Tau 640 before they learned about the Quark.

"No question about it. The reason we chose Quark was because of size and form factor. It has a very good center of rotation; because our camera is front-mounted, it was easy for us to recommend Quark," Messerschmidt said. "Because it's so small, we can actually place a daylight and thermal camera next to each other, enabling dual sensor capability which is unique on this small platform."



Huginn X1 Dual Imaging Payload with Quark 640



Multiple Surveillance applications



Thermal capability thanks to Quark™



Integrating Quark into Huginn X1

Once Sky-Watch selected Quark as its thermal payload, they faced a few challenges integrating the core into their system. First, they initially tried to design their own interface board to power the core and stream video. However, their design created too much noise so they turned to the VPC interface board FLIR designed specifically for Quark and found that it worked perfectly.

The second challenge involved calibration, or flat-field correction (FFC). FFC is necessary to maintain a more uniform thermal image. Since Quark does not have a shutter, an FFC must be performed using an external reference source. Sky-Watch solved this by developing a pan/tilt on the Quark that tilts it inward to face a "flat field." This action sends an FFC command to Quark to correct the image. Quark initially calibrates whenever it's powered on, but the X1 drone operator can initiate an FFC calibration at any time from the user interface. An example of when this capability is most necessary is with Sky-Watch's fire brigade customers. "As the drone approaches the fire, the atmosphere gets warmer, so we empower the user to calibrate to the new environment, thereby optimizing the output, and in turn helping the user to make more founded decisions," Messerschmidt said.

Once Sky-Watch plugged into the Quark VPC, they created all the controls and software that operates the camera. From a ground station, an operator can control X1 from more than a mile away with the user interface. Control features include:

- Video recording via live feed on the ground station computer
- Designating a waypoint route and points of interest on the way prior to launch
- Guide in real time based on live video feedback

- Spot control: If you want to look at a building that appears in the right corner of the operator display, then simply click on the building and the camera will automatically center on that building

Flight time for a single payload is 23 to 24 minutes; for a dual payload that time drops to about 21 minutes.

Finally, Sky-Watch added another layer of protection for the Quark by designing the X1 with a front-mounted payload. Many small drones have bottom-mounted payloads. When a drone with a bottom-mounted payload lands hard or crashes, there is a greater risk of damage to the payload. Also, when X1 lands, Quark automatically turns upward from the ground to protect the lens.

Going to Market

The small UAV market is still in its infant stage, but there are hundreds of four-rotor systems available. However, the competition narrows for defense and security applications due to the rigorous design requirements.

Quark gives Sky-Watch a competitive edge because it increases flight time. X1 is the only platform of its size that weighs less than 1.5 kg (3.3 lbs.) and has dual sensor capability. That's a major selling point and another reason Messerschmidt always brings his Quark on sales calls to perform demonstrations.

"I would say that a year from now, 60 percent of our orders will include the Quark option, either as a dual mount or a single mount. It's simply what customers want; they want this thermal capability and ask me to quote it right away."

Conclusion

Sky-Watch integrated a Quark 640 longwave infrared thermal sensor into its Huginn X1 quad-rotor UAV and is finding that there's a high demand in the market for their drone. Its combination of size, performance, and thermal capability make it a standout in the small UAV market.

Sky-Watch worked with FLIR to integrate the Quark and get it operational as quickly as possible. According to Messerschmidt, "We are very happy with the collaboration. The Quark is a very good product. All the feedback we've received has been overwhelmingly positive."



Specifications	Quark 640
Detector	
Type	uncooled microbolometer
Resolution	640 x 480
Spectral Range	7.5 – 13.5 μm
Pixel Size	17 μm
NETD	<50 mK at f/1.0
Electronics / Imaging	
Time to image	< 5 seconds
Frame Rate	30 Hz NTSC
Power Consumption	<1.2 W
Analog Video Output	NTSC or PAL
Optics	
Lens Options (in mm)	6.3, 13, 14, 17, 19, 25 and 35
General	
Weight w/o lens	8 g
Mounting	4, M1.6 x 0.35
For full detailed specifications visit: www.flir.com/cvs/cores/	

WE KNOW INFRARED. LIKE NOBODY ELSE.

FLIR invented the infrared camera industry as we now know it. We brought the first commercial IR camera to market in the 1960s and have piled up more industry firsts in thermal imaging than anyone. Today we are the only global company totally dedicated to finding and fixing thermal problems through IR imaging systems. Our company's mission is to provide the most innovative systems available, with the highest possible quality, and show thermography practitioners how to get the most out of them. Our goals, now and in the future, are to provide greater insight into all types of thermal phenomena, and help our customers save money by applying this knowledge. This is supported by the most comprehensive and respected training courses in the industry.

FLIR's 'smart' IR cameras are used in basic research, non-destructive testing, product development, factory automation, equipment and building maintenance, asset protection, medical diagnostics, public safety, national defense, and a host of other applications. No other company offers the breadth of thermal imaging/temperature monitoring products supplied by FLIR, and none is as dedicated to technical excellence as our 350+ engineers. Within the past three years alone, FLIR has spent more than \$230 million on R&D. Our customers are the primary beneficiaries of this investment, enjoying an ROI that amounts to millions of dollars a year in direct savings from operating efficiencies and loss avoidance. As a result of this leadership, FLIR is the most trusted name in the industry.

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

FLIR Commercial Systems

Luxemburgstraat 2
2321 Meer
Belgium
Tel. : +32 (0) 3665 5100
Fax : +32 (0) 3303 5624
e-mail: flir@flir.com