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When to Choose HOT MWIR Over Uncooled LWIR

Cooled midwave infrared (MWIR) cameras have long held a tactical advantage over uncooled longwave infrared (LWIR) cameras in many airborne and ground-based missions. But while cooled MWIR cameras are highly sensitive, they are also larger, heavier, require more power, and cost more than uncooled LWIR cameras. Recent advancements in High Operating Temperature (HOT) MWIR technology, however, opens up new possibilities. The FLIR Neutrino™ LC is a new size, weight, and power (SWaP) optimized HOT MWIR camera that fits in the palm of your hand, uses less than four watts, and is suitable for missions previously dominated by uncooled LWIR cameras.

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Why HOT MWIR Might Be a Better Fit than Uncooled LWIR

Cooled midwave infrared (MWIR) cameras have long held a tactical advantage over uncooled longwave infrared (LWIR) cameras in many airborne and ground-based intelligence, surveillance, and reconnaissance (ISR) use cases. While cooled MWIR camera modules are highly sensitive, they are also more mechanically complex, larger, heavier, have a shorter mean time between failures (MTBF), require more power, and cost more than uncooled LWIR cameras. Many years of work both by the US government and industrial organizations as part of a consortium called VISTA (Visible Infrared Sensor Technology Advancement) has led to advancements in High Operating Temperature (HOT) MWIR, uncooled LWIR and dual-color detector designs. The FLIR Neutrino™ LC is a new size, weight, and power (SWaP) optimized HOT MWIR camera that fits in the palm of your hand, uses less than four watts, and is suitable for missions previously dominated by uncooled LWIR cameras.

Cooled MWIR - Sensitivity Leadership

The physics of how IR is converted to an electrical signal is fundamentally different when comparing cooled MWIR to uncooled LWIR, but a good rule of thumb to use when contrasting the two is that the cooled MWIR sensor is roughly 100 times more sensitive than microbolometer-based uncooled LWIR cameras. This difference in sensitivity opens the system design trade space, allowing cooled cameras to have significantly smaller lenses at the same focal length through increased optics f-number. For example, an f5.5 cooled camera system with a 200 mm focal length would achieve comparable object detection ranges as an f11.0 uncooled system with a 200 mm lens, while being significantly smaller and lighter. There are several performance requirements to consider in the trade space, but it is reasonable to state that imaging distance requirements of up to 1 km are appropriate for uncooled LWIR, and cooled MWIR has an advantage at distances greater than 1 km. As shown in Table 1, at 1 km the optic size and associated weight impact physical design. A 100 mm f11 uncooled LWIR optic is big, heavy, and the most expensive component in an uncooled LWIR camera so equipped.

| Imaging Distance (Required Lens) | Uncooled LWIR (f11) Optic Diameter (mm) | MWIR (f5.5) Optic Diameter (mm) | Design Advantage |
|----------------------------------|---|---------------------------------|------------------|
| <1 | <100 | <10 | Uncooled LWIR |
| 1 | 100 | 10 | Cooled MWIR |
| 2 | 200 | 30 | Cooled MWIR |

Table 1: Imaging Distance vs. Optic Diameter

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