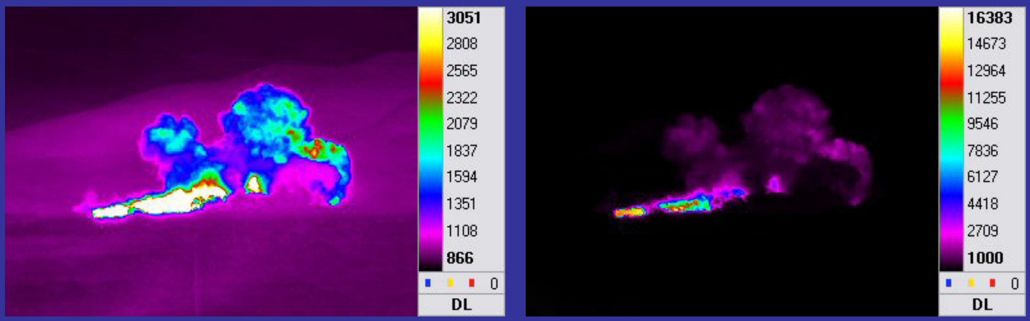
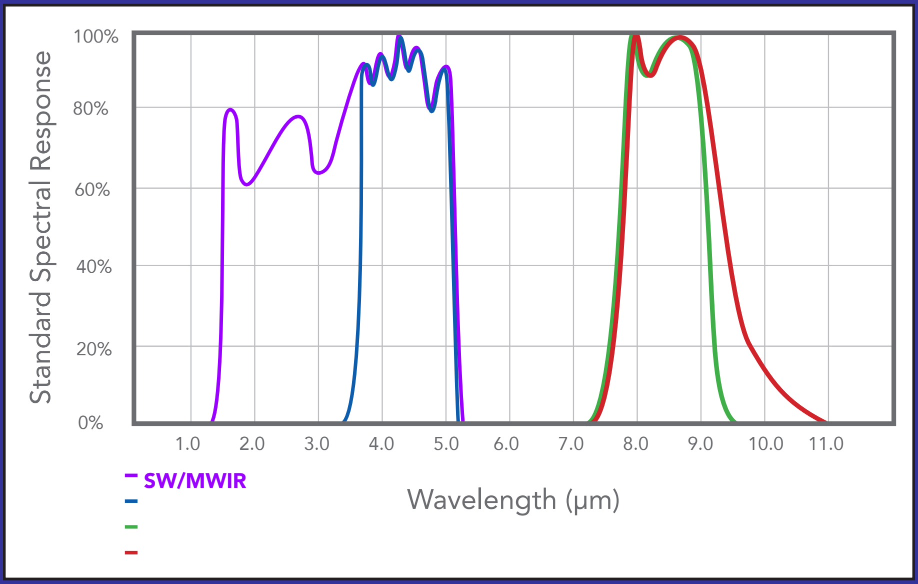
Access to the world's leading infrared imaging technology

LWIR or MWIR Infrared Imaging: Which is best for your application?





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Many commercial imaging applications require the use of infrared cameras having cooled detectors because of their far superior sensitivity, spectral behavior, response time and frame rate. Proper selection of the optimal infrared band can be tricky. These detectors can be optimized to operate in different spectral bands as a result of the dewar window and cold filter transmission characteristics or the active temperature of the FPA. As shown in Figure 1, photovoltaic infrared detectors (such as MCT and InSb) are currently available for imaging is several distinct bands, including SW/MWIR (1.5-5.0μm), MWIR (3-5μm), LWIR (7.5-9.5μm) and VLWIR (7.5-11μm).

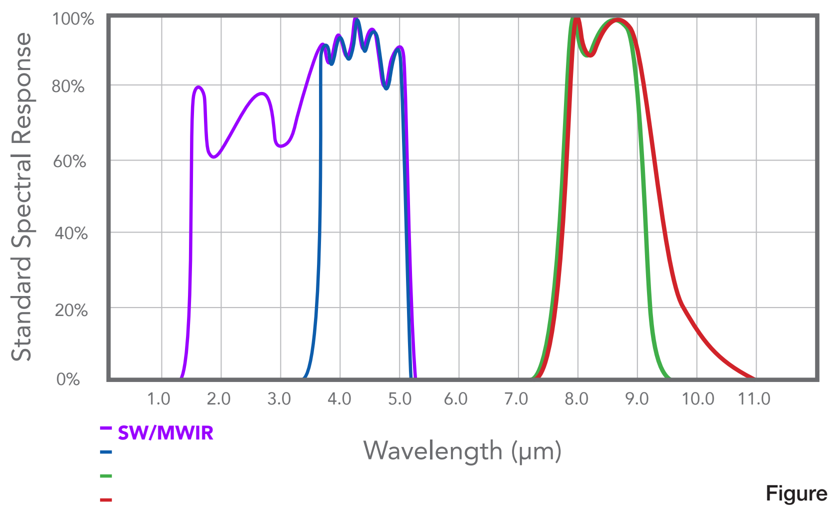

Figure 1

Certain applications may require imaging in a specific infrared spectral band due to the nature of objects being viewed. For example, in spectroscopy, spectral absorption properties may dictate the use of the SW/MWIR band, while laser beam imaging applications may require imaging at 10.6μm, for example.

Alternatively, in other applications, the objects of interest may span a very wide temperature range requiring intra-scene imaging of both hot and cold objects. In such cases, a high performance LWIR system would be superior to the MWIR system because of its very broad dynamic range capability. A common example is the viewing of the test firing of a solid rocket booster. Such an extended intra-scene dynamic range would not be possible with an MWIR system. The impressive performance of the LWIR System is easily explained by comparing the flux in the LWIR band with that in the MWIR band. As calculated from

Planck's curve, the distribution of flux due to objects at widely varying temperatures is smaller in the LWIR band than the MWIR band when observing a scene having the same object temperature range. In other words, the LWIR infrared imaging system can image and measure ambient temperature objects with high sensitivity and resolution and at the same time extremely hot objects (i.e. >2000K). Imaging wide temperature ranges with an MWIR system would have significant challenges because when the latter is adjusted so that the detector does not saturate due to the energy from the high temperature object (by optical attenuation or short integration times), the result is poor sensitivity for imaging at background temperatures.

Figure 2

Optimum Spectral Band Choices for Certain Common Infrared Imaging Applications

APPLICATION	SWIR	MWIR	LWIR
Laser imaging	Depends on laser wavelength		
Spectroscopy	Depends on object absorption		
High speed imaging	High speed imaging	High Temp Objects	Low Temp Objects
Long range, high magnification surveillance with atmospheric absorption		X	
Long range, high magnification surveillance with atmospheric absorption			X
Imaging through high moisture atmosphere		X	
Imaging through smoke/dust			X

Ironically, the LWIR imaging system is not only suitable for high intra-scene dynamic range applications, but also uniquely suited for high contrast imaging when the amount of scene flux is quite small. As an example, consider the application of infrared imaging of cold objects at temperatures down to -100°C. These objects have very little infrared radiation. However, an MCT-based LWIR imaging system has the unique ability to image and measure these very cold objects. Figure 4 shows the detector response measured as a result of objects at temperature of about (-50°) to (-95°) C. Clearly, an MCT-based LWIR system can adequately measure and distinguish the radiation from objects at temperatures down to (-100°) C. In addition, it has been shown that the full object temperature range can be imaged with one detector integration time.

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SOFRADIR-EC

373 US Hwy 46W Fairfield, NJ 07004 973-882-0211 Fax: 973-882-0997
info@sofradir-ec.com **www.sofradir-ec.com**

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