Application Note: Defense applications for SWIR InGaAs cameras

Key performance indicators:

- *SWIR InGaAs imagers are sensitive to nightglow (1 to 1.6 µm)*
- *SWIR InGaAs cameras can be uncooled, small, lightweight and low-power*
- *Covert and eye-safe lasers, e.g., at 1550 nm, can be used to illuminate targets*

Unlike LWIR and MWIR imagers, SWIR imagers see reflected light. SWIR InGaAs cameras offer unique capabilities, complementary to LWIR and MWIR cameras.

Detection of laser designators

Many applications exist for lasers on the modern battlefield: range-finding lasers are used to detect the range of an object whereas target designator lasers are used for attack.
The most common military lasers operate around 850 nm, 1060 nm, or 1550 nm. The first two types are visible to night vision goggles; the third one, 1550 nm, is therefore considered covert. SWIR InGaAs cameras are able to see all three at the same time.

Nightvision and target recognition

Thermal imaging cameras, such as LWIR uncooled microbolometer cameras, have excellent detection abilities at night. SWIR InGaAs cameras however, are a good complement to thermal imaging cameras.
While thermal imaging can easily detect the presence of a warm objects, e.g., cars, trucks, people etc.., in a cooler environment, a SWIR camera can be used to identify and recognize those objects. SWIR nightvision is based on reflection of infrared rays from atmospheric glow or nightglow rather than on thermal radiation. Therefore, SWIR images are close representations of what is seen in the visible spectrum (see Fig. 1). Compared to thermal imagers, SWIR InGaAs cameras also have a better dynamic range.
Obviously, a VISNIR InGaAs camera benefits from its ability to see more wavelengths when there is some visible light present, for example from street lights or urban glow. Additionally, by using SWIR illumination for example 1550 nm LEDs or lasers, a scene can be covertly illuminated, i.e., viewing is only possible with a SWIR camera. Moreover, SWIR lasers are eye-safe, i.e., they can be used to safely illuminate targets and humans.

Fig. 1: Nightvision with SWIR InGaAs camera XEVA 1.7 320 TE1
-picture taken at midnight, partly cloudy, few stars, no illumination used-

sInfraRed Pte Ltd
221 Queensway #12-10 - 276750 Singapore
Co.Reg.No. 200811147D

Laser gated imaging

Laser gated imaging allows for imaging at long distances while reducing the effect of obscurants in the atmosphere. In laser gated imaging, a pulsed laser is used to illuminate the scene while the reflected light is detected by a camera with a short exposure or gating time. The exposure is delayed so imaging occurs at a particular distance, thus the image is only from the reflection of objects at that distance. When using a SWIR InGaAs camera, covert and eye-safe pulsed lasers can be used.

Situational awareness – gunshot detection

Acoustic sensors that “listen” to the shockwave of a bullet are not the only solution for gunshot detection. Gunshot signature can be identified, located and processed even faster using high-speed SWIR InGaAs cameras, either at night or during daytime. The combustion gases and hot debris projected from the gun upon firing are detectable.

Seeing through haze, smoke and fog

Compared to visible cameras, SWIR InGaAs cameras offer superior performance in imaging through dust, fog, haze or smoke (see Fig. 2). In case of fire, the location of the flames can easily be found.

Fig. 2: Seeing through smoke

Visible image SWIR InGaAs image

Airborne reconnaissance, remote sensing and surveillance

Small, low-power and lightweight SWIR InGaAs cameras can be used on airplanes and UAVs (unmanned air vehicles) for reconnaissance and surveillance missions. Hyperspectral SWIR cameras can be used to detect the unique spectral signature of militarily important items, for example camouflage material.