Introduction to Active Imaging

Introduction

One of the most common ways of categorizing imaging systems is to consider whether they are “active” or “passive”. Standard night vision systems are based on thermal or intensified cameras and usually operate as passive systems. This means that the system does not send out any energy, but only act as a receiver. This energy, which could be emitted by warm bodies or ambient light reflected from the objects, is then concentrated on the detector.

On the other hand, when using a light source to illuminate a target and collect the reflection from an object, the camera becomes an active system. In this case, the camera can acquire imagery, day and night, in various lighting conditions.

The majority of night vision systems are passive. To operate adequately, intensified cameras require moonlight or ambient light sources. Active systems do not require ambient light to perform adequately, as are all radar devices, LIDAR systems, and the ARGC-2400 camera.

The illuminator of an active system can be either operated in continuous mode or in flash or pulsed mode. The range performance of the pulsed active system is much better than the performance of continuous mode active systems, however they are more complex. Continuous mode active systems use standard sensors and illuminators widely available on the market, as the pulsed active systems use specifically designed components to achieve the superior performance. Obzerv’s laser illuminator is using a pulse technology.

Obzerv’s innovative night vision systems are based on two core technologies: range gating and Obzerv laser illuminator.

Range Gating Technology

Obzerv’s active imaging systems incorporate range-gating technology, also known as time gating technology.

The range gating technology combines two key components: a pulsed laser beam and a specially designed light intensifier that opens and closes at very high speeds.

Here is how we can illustrate active range-gating technology: A laser pulse is sent toward the target; when the reflection is back from the target, the integrated high-speed electronic shutter will turn on at just the right instant. Gating technology lets operators select a specific slice of space, so they view the target site, minus parasitic lights and

backscattering from aerosol particles. Intense parasitic lighting in the field of view is never a problem, thanks to range-gating technology and laser illumination. By selecting a gate width (slice of space that is narrow enough), Obzerv improves the signal to noise ratio significantly.

Details of the principle of operation

- At t_0 , a laser pulse is emitted (while the camera is closed)
- At t_1, the laser pulse is reflected by the targeted object
- At t_2, the camera is opened for a short period (Δt) corresponding to the desired depth of view

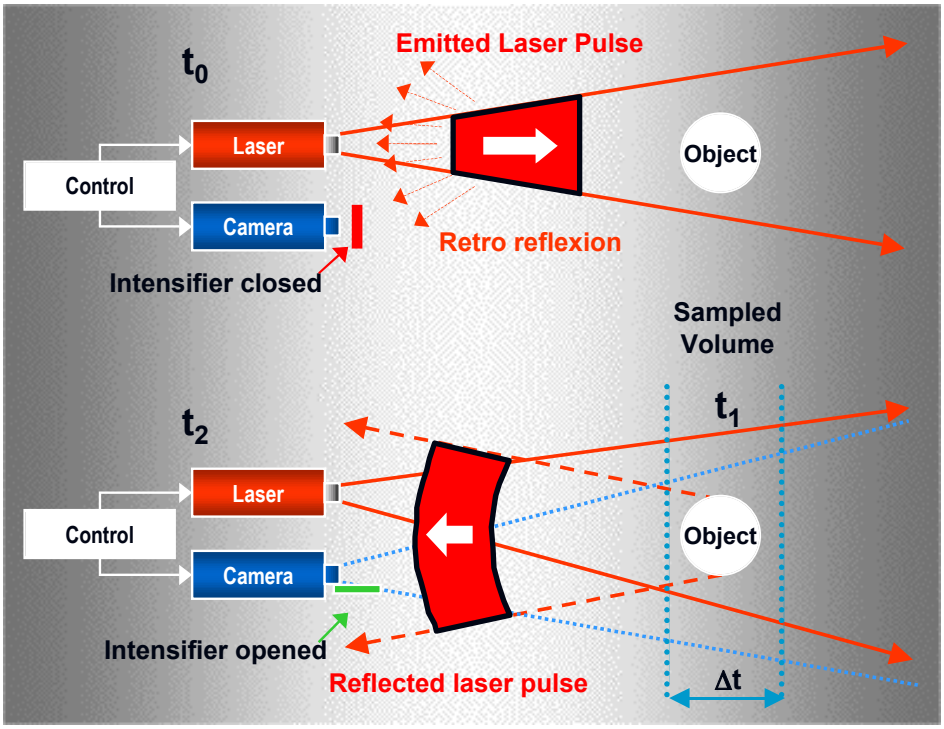

Figure 1. Diagram of the range gating technology

Excess Light Never A Problem

Interference from strong parasitic light or water vapor from rain, fog, or snow (which can reflect the illuminator laser beam in front of the selected scene) is greatly reduced. This is the result of the synchronization between the light source and the camera sensor. The camera is perfectly synchronized with the laser pulse. If the laser pulse is reflected back by snow or fog particles, these reflections will arrive too early at the camera while the shutter is closed. Since the sensor is turned off most of the time, the camera is not

affected by parasitic light sources.

The Obzerv camera is never blinded by parasitic light, unlike intensified cameras.

Obzerv Laser Source Technology

The heart of the Obzerv laser source is its patented collimation technology. With it, we're able to produce extremely powerful and efficient illuminators that deliver uniform beams matching the FOV of the sensor. These properties are essential for illuminating objects at a distance and for generating high-quality images. Other existing laser sources lack the power and beam uniformity to produce images with the quality needed to gather legal evidence.

Benefits

- Power and pulse capacity: surveillance in difficult weather conditions and significant reduction of parasitic light.
- Exclusive laser source: outperform competing products in image quality and range.
- Operating wavelength: See-through glass capacity, detection of pointed optics, detection of camouflage nets, reading characters and markings (which is not possible with a thermal imager).

Difficult Light Conditions

Through range-gated technologies, Obzerv systems can allow efficient surveillance in difficult lighting conditions when other technologies have difficulties, particularly with parasitic light sources or contrasted lighting conditions.

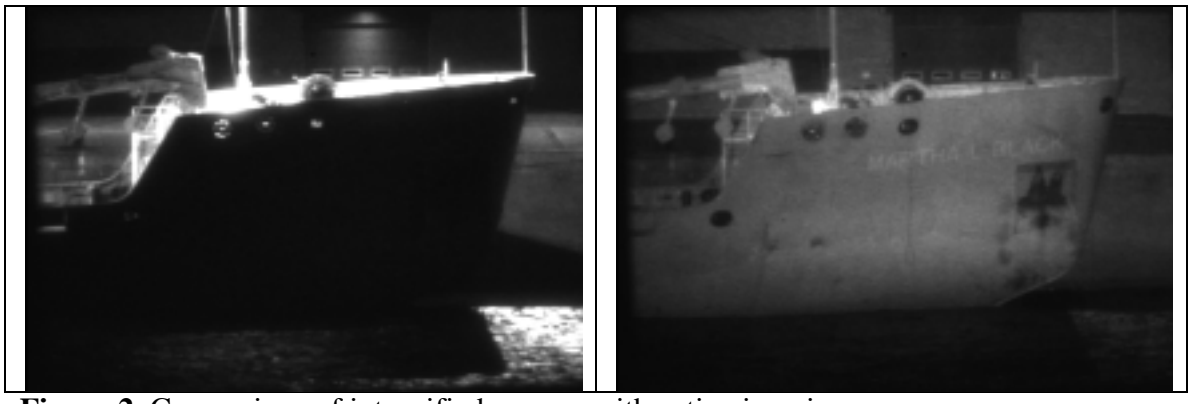

Figure 2. Comparison of intensified camera with active imaging camera.

The image on the left was captured from a top of the line, intensified camera (GEN III Omni 4) while looking at the "Martha L. Black" at 1.4 km. The image on the right was captured from an Active Imaging camera. It is worth noticing the uniform image brightness, the lettering and details off the hull.

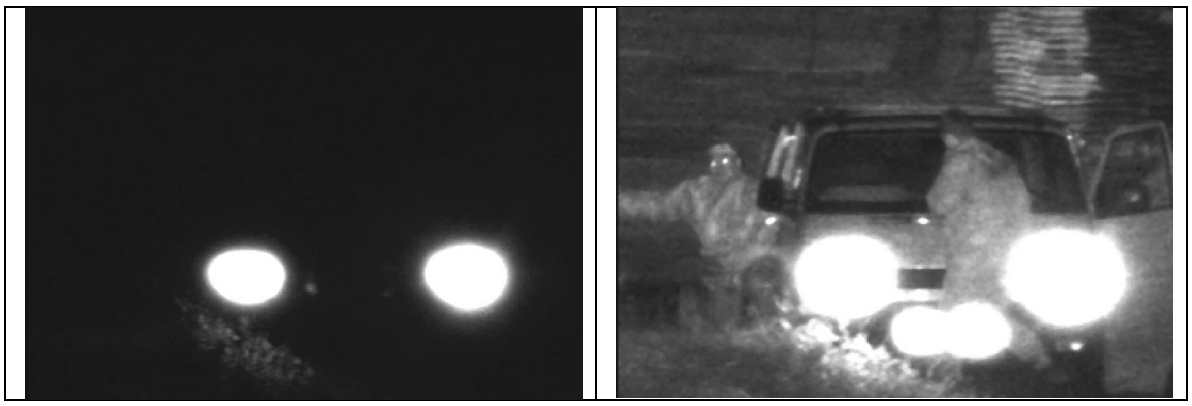

Figure 3. Comparison of intensified camera with active imaging camera.

The image on the left was captured from an intensified camera (GEN III Omni 4) while looking at a minivan at 750 meters with the headlights turned on and people walking around. The image on the right was captured from an Active Imaging camera. Despite the headlights being turned on, it is very easy to identify the movement and activities of the individuals.

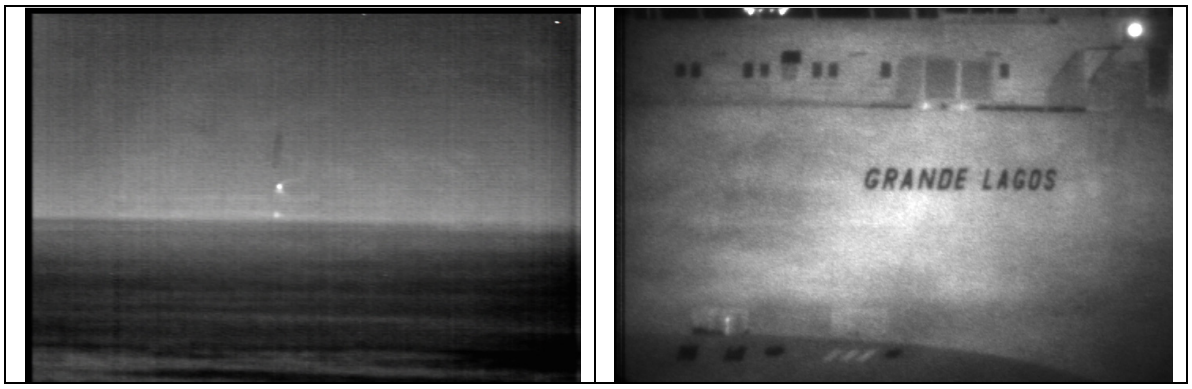

Figure 4. Comparison of uncooled thermal camera (left) with active imaging camera. 6.4 km on the right.

At 6.4 km, the first image on the left comes from an uncooled Thermal camera using an *f*/1, 200 mm length lens. The chimney and the profile of the ship can be seen. The second image was taken with Obzerv's range gated camera. 17-inch letters can easily be read.

See through glass

For surveillance and identification purposes, it is essential to be able to see as far as possible. As an example, if individuals sit inside a vehicle, seeing through glass becomes a significant advantage, which thermal imaging cannot deliver.

Figure 4. Observation through glass.

At 750 meters, with headlights turned on, it is possible to watch individuals sitting inside a car through the windshield. Here, we see an individual in the driver seat and another sitting at the back. Note the high return from the eyes of each person.

Detection of Pointed Optics

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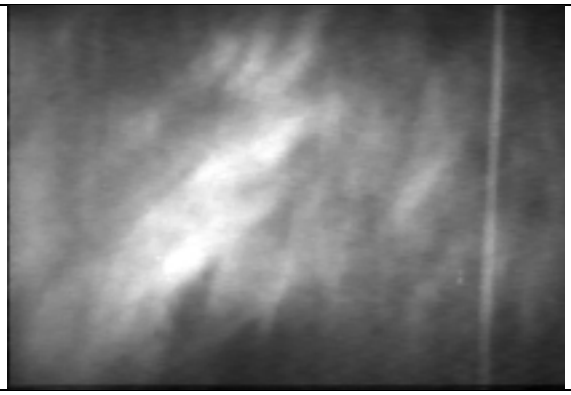
Figure 5. Detection of Pointed Optics

At a distance of 2 km at 4:00 PM during a sunny day, various sensors are used to detect a sniper rifle scope (Dragunov), top left picture was taken with color sensor from Obzerv ARGC-750, top right picture was taken with an Thermal Imager Sophie MF and the bottom left corner using Obzerv ARGC-750 Active Range Gated sensor. The same function can be done at night with astonishing results.

Degraded weather Conditions

Obzerv's range-gated technology is also improving performance through weather conditions like snow, rain, dust, and fog. The following sequence of images is an example of the capacity of the gated system to reject annoyances caused by conventional lighting. This capability makes a tremendous difference for being able to maintain adequate surveillance during adverse weather conditions.



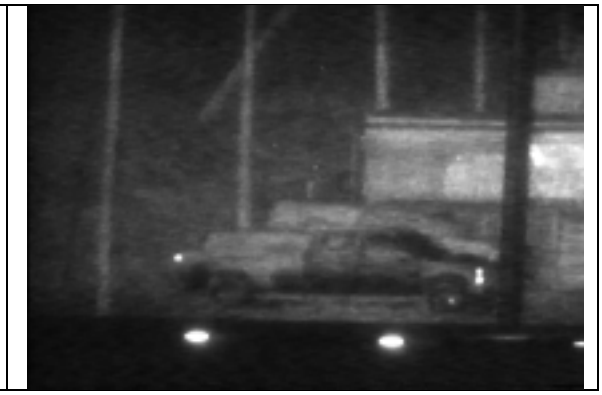


Figure 6. Observation in bad weather.

Looking at vehicles at 500 meters during a snowfall produced the above images. On the left, a continuous non-gated active imaging system, which dazzles itself from the

reflection of the falling snow. On the right, Obzerv's active range gated imaging removes those reflections and allows observation of the desired target.

The ARGC-2400 active range-gated system takes advantage of a series of cutting-edge technologies developed and integrated by OBZERV Technologies. Key features include the range gating technology and the Obzerv illuminator with a near-infrared laser beam. Also included in the ARGC-2400 is a high magnification continuous motorized zoom telescope (60 to 240 magnification) and an intuitive user-friendly interface. Moreover, accessories like laser range finder, two color CCD cameras for daytime operation and a GPS facilitate operations and supply critical data in real time on the touch screen monitor.