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Abstract

Verification of Applicability of Long Focal MWIR Infrared Camera †

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Abstract

Infrared cameras play an important role in various fields, such as research and development, and inspection and surveillance; the higher the performance of an infrared camera, the more important the specifications are. However, in the field of long-range surveillance, it is difficult to strictly grasp the performance of infrared cameras because they are affected by atmospheric conditions. The performance of DRI (Detection, Recognition, Identification), one of the specifications used in infrared cameras for surveillance, is merely a simulated value from each company. In this verification, we used a MWIR long focal infrared camera to verify whether there was any difference between the simulation values in a real environment and the actual usage conditions.

Keywords: long focal length; MWIR; surveillance; DRI

1. Introduction

In recent years, the demand for long focal infrared cameras has been increasing in the defense and security fields. DRI, an important specification for infrared cameras for surveillance, is a simulation value provided by each company. In this article, we will introduce some images taken with a long focal infrared camera to show how we actually obtained the images.

2. Experiment

The cameras we used for this experiment were cooled infrared cameras (products from Noxant SAS, Paris, France) with a resolution of 1280 × 720 pixels and maximum focal lengths of 900 mm and 690 mm. The chosen scene is shown in Figure 1.

Figure 1. The chosen scene.

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Also, the DRI of these cameras is shown in Table 1. However, the performance of DRI is affected by various environmental factors such as the atmospheric path, temperature, and humidity. So, it is difficult to quantitatively evaluate it through this observation.

Table 1. This is a table of the DRI specification list.

Maximum Focal Length	Type	D	R	I
900 mm	Vehicle	28.5 km	19.4 km	12.6 km
	People	21.7 km	11.0 km	6.2 km
	UAV	12.7 km	5.2 km	2.7 km
690 mm	Vehicle	26.8 km	16.7 km	10.4 km
	People	18.9 km	8.9 km	5.0 km
	UAV	10.5 km	4.1 km	2.1 km

Atmospheric attenuation coefficient is assumed to be 0.82 db/km, $\Delta t = 2$ °C.

2.1. Image of a Ship and a Bird About 20 km Away

Figure 2 shows an image of a ship and a bird traveling 20 km ahead taken by an infrared camera with a focal length of 900 mm. Figure 3 shows an enlarged image of the bird in Figure 2.

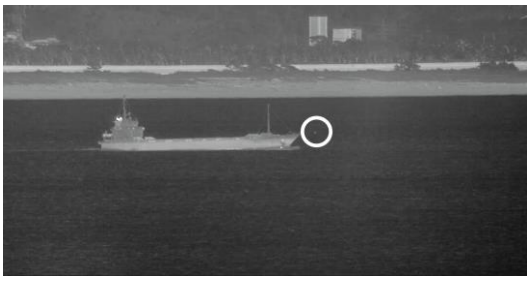

Figure 2. An image of a ship and a bird traveling 20 km ahead.

Figure 3. The image shows an enlarged image of the bird in Figure 2.

The bird's size is estimated to be about 40 to 60 cm. The DRI of the UAV (assuming 0.5 m × 0.3 m) holds a D value is 12.7 km, but it can actually be detected from 20 km away.

2.2. Image of a Yacht About 30 km Away

Figure 4 is an image of a yacht about 30 km away. This is clearly an image we can judge as a yacht, so it corresponds to R; the vehicle's R is 28.5 km according to the specifications, but it can actually be recognized even from a distance of about 30 km.

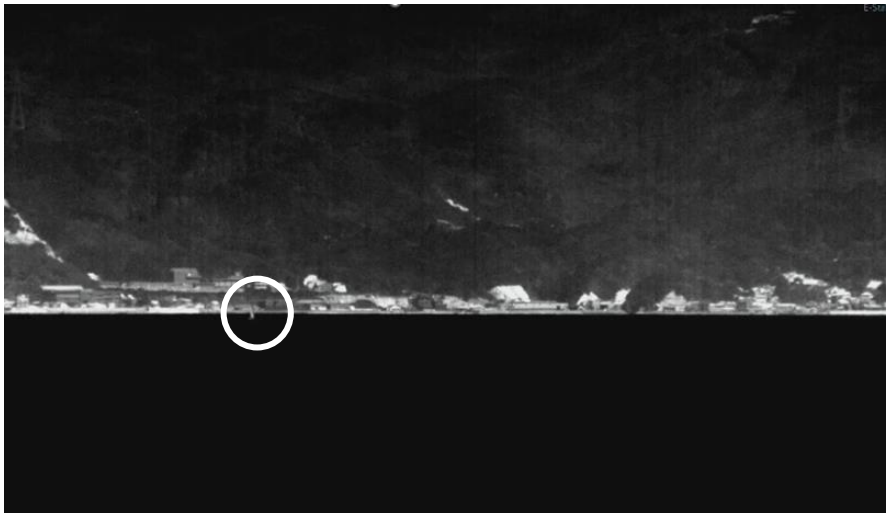

Figure 4. An image of a yacht about 30 km away.

2.3. Comparison of Maximum Wide Angle and Maximum Narrow Angle Between Focal Lengths of 900 mm and 690 mm

These are the images taken from about 36 km away from the summit of Mt. Fuji to compare the maximum wide angle and maximum narrow angle of 900 mm and 690 mm. The images were taken on different days, but at the same location (Figures 5–8).

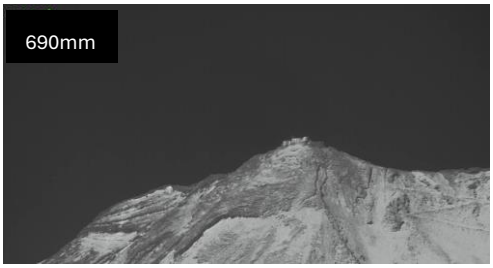

Figure 5. The maximum narrow angle of 690 mm.

Figure 6. The maximum narrow angle of 900 mm.

Figure 7. The maximum wide angle of 690 mm.

Figure 8. The maximum wide angle of 900 mm.

Although there are differences between Figures 5 and 6, when used for actual surveillance purposes, we think there is little difference if the purpose is detection.

Also, when comparing Figures 7 and 8, Figure 8 has a narrower angle. So, the wide-angle side is also narrow, giving the impression that it is not sufficient for surveillance purposes to see the whole picture.

3. Summary

We introduced some images taken with a long focal infrared camera. As a result, it is possible for the actual DRI value to exceed the specification value. However, this is difficult to define precisely because it is affected by weather, and the atmospheric path between the target and the camera becomes more complex at longer distances. Therefore, it is very important to check the performance under all possible conditions, assuming actual environment.

Also, as we understand from the comparison of images of the summit of Mt. Fuji, selecting a camera for long focal surveillance is not as simple as choosing a camera with a long maximum focal length. It is important to select the focal length range comprehensively according to the application (target size, detection range, etc.).

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