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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, inspection and surveillance, and 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 those 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. The 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 images we get actual.

2. Experiment

The cameras we used for this time were cooled infrared cameras with a resolution of 1280x720 pixels and maximum focal lengths of 900mm and 690mm. The taking scene is shown in Figure 1.



Figure 1.

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And 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.

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

※Atmospheric attenuation coefficient is assumed to be 0.82 db/km, $\Delta t = 2^{\circ} \text{C}$.

Table 1. This is a table of DRI spec list.

2.1. Image of a ship and a bird about 20km 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.

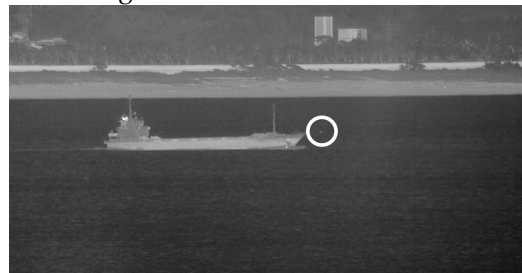


Figure 2



Figure 3

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

2.2. Image of a yacht about 30km away

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

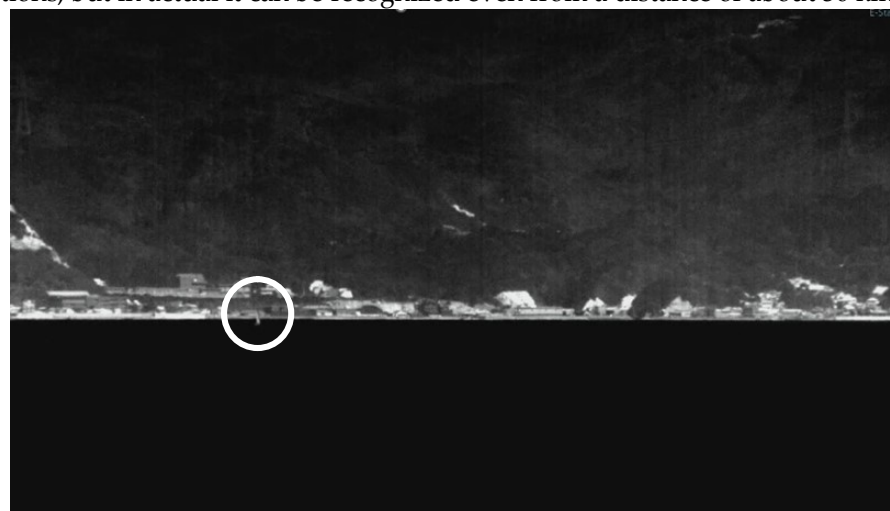


Figure 4

2.3. Comparison of maximum wide angle and maximum narrow angle between focal lengths of 900mm and 690mm

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 (Figure 5, Figure 6, Figure 7, Figure 8).

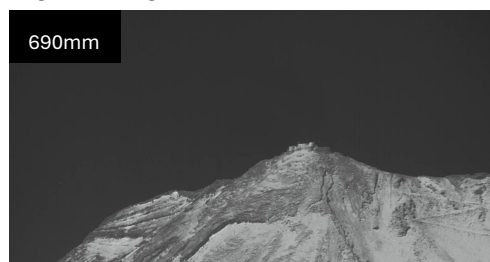


Figure 5

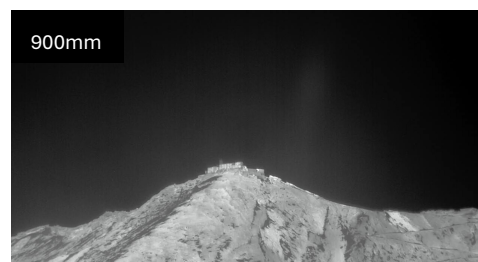


Figure 6

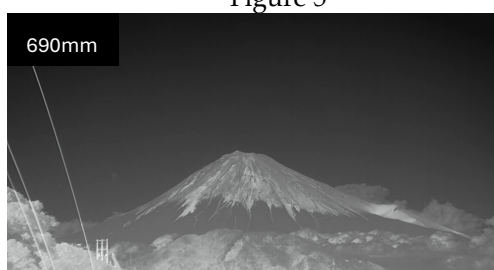


Figure 7



Figure 8

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

Also, when comparing Figure 7 and Figure 8, Figure 8 has a narrower angle, and 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, the actual DRI value is possible to exceed the spec 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).

References

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