

# **VEHICLE MOUNTED THERMAL IMAGER USED AS AN AIRFIELD WILDLIFE CONTROL TOOL**

**Kathleen Gurski**

Canadian Department of National Defence  
4 Wing Cold Lake,  
Alberta  
October 2008

## **ABSTRACT**

A good wildlife control program is a vital part of any aerodromes' flight safety system, and its' importance cannot be overemphasized. A flock of birds or a single deer can cost time, money and lives.

All objects emit a certain amount of black-body radiation as a function of their temperatures. Generally speaking, the higher an object's temperature is, the more infrared radiation as black-body radiation it emits. A special camera can detect this radiation in a way similar to an ordinary camera does visible light. It works even in total darkness because ambient light level does not matter. This makes it useful for rescue operations in smoke-filled buildings, underground and as a Wildlife Control tool. The 4 Wing Wildlife Control (WC) Team now has the capability to detect, recognize, identify, locate, and track potentially hazardous wildlife within the GRA under all conditions of visibility, thanks to a new tool in the form of a Thermal-Eye Vehicle Mounted Thermal Imager (VMTI). The VMTI allows the WC Team to scan the aerodrome for potentially hazardous wildlife with minimum interference to air traffic. Prior to purchasing the VMTI, the WC Team was using a million candle watt spotlight. The spotlight proved to be inadequate due to light diffusion and ambient light from the runways, taxiways and ramps severely reducing the range of the spotlight. Pilot's lives and expensive equipment were risked based on us being able to see glowing eyes in the beam of a spotlight!

The paper will discuss the benefits of the VMTI system and its uses in wildlife control within an aerodrome setting.

Every year the Canadian Forces spend millions of dollars and hundreds of man-hours in maintenance because of damage to aircraft caused by bird/mammal strikes, to replace a single engine can be up to 2 million dollars alone! The aim of the 4 Wing Wildlife Control Program is to minimize bird strikes and wildlife hazards to aircraft and the aircrew. This is accomplished through habitat management, wildlife monitoring, dispersal techniques, education of Wing personnel, strike reporting and our new vehicle mounted thermal imager (VMTI). The 4 Wing Wildlife Control (WC) Team now has the capability to detect, recognize, identify, locate, and track potentially hazardous wildlife within the General Restricted Area (GRA) under all conditions of visibility.

4 Wing Cold Lake is a military aerodrome located in northeastern Alberta, Canada. One operational CF-18 squadron, one Test squadron, one Search and Rescue squadron and two training squadrons, including Phase IV of NATO Flying Training in Canada (NFTC), and numerous premier support units, make 4 Wing Canada's largest and busiest fighter wing.

The aerodrome has two parallel runways, which run Southeast and Northwest - 31/13, and one crossing Northeast/Southwest - 22/04. The general traffic profile is formation take offs, an average of 2-3 aircraft per flight, which return for circuit work, either VFR or IFR at a circuit altitude of 1500 AGL (transport or civilian aircraft fly at an even lower altitude). The aircraft may do full stops, low approaches or touch and go's while in the circuit. During May and June, 4 Wing hosts several foreign nations in an exercise called Maple Flag. During this period, the traffic is generally "overhead breaks" with full stop landings due to the high volume of aircraft recovering. 4 Wing averages two MedEvac flights a week, which are generally a turboprop BE20 aircraft. Due to the nature of the turboprop aircraft, the MedEvac flights are considered high wildlife risk flights. Wildlife hazards vary based on the different patterns of flight operations between the local and itinerant traffic.

The surrounding land use is largely agriculture and oil gas production. The Beaver River Valley, Marie Creek and Palm Creek border the aerodrome on three sides and Alberta's largest lake, Cold Lake, is located 8 kilometres from the base. Sightings of mammals, birds and amphibians are noted by the WC Team, collected and used in the development of our Wildlife Management Plan (WMP). A total of 60 bird species, 3 amphibians and 22 mammals have been observed within the Wildlife Control Area. Many of the species are either transients or occur during the spring and fall migration periods or during the mammal breeding seasons (i.e. white-tailed deer during rut).

The current aerodrome has 2000 acres surrounded by 13 kilometres of perimeter fence. These acres include grassy meadows created from old pastureland; forested areas, drainage ditches, and low-lying spots that become seasonal wet lands.

The Wildlife Control Team (WC Team) consists of two people who split the flying hours. They are equipped with binoculars, a truck, lethal and non-lethal ammunition and a firearm to patrol the 2000 acres! Prior to 2006, and the acquiescing of the VMTI; wildlife sightings were due more to luck than anything else. The WC Team attempts to patrol the aerodrome prior to all

takeoffs and recoveries but access to the active runway is often limited. Pre-VMTI, the team had to rely on naked eye or binocular observations while driving down the Service road, approximately 700 ft from the runway. The ability to see the runway clearly was often affected by weather and time of day. During night flying operations the WC Team was using a million candle watt spotlight. The spotlight proved to be inadequate due to light diffusion and ambient light from the runways, taxiways and ramps severely reducing the range of the spotlight. Pilot's lives and expensive equipment were risked based on us being able to see glowing eyes in the beam of a spotlight!

In the winter of 2004/05 several hundred acres of trees were removed from the aerodrome disrupting the local white-tailed deer herd. The deer were now wandering further from the remaining bush line and when chased they were more apt to panic than return to the now diminished bush. Around the same time the Military Police purchased a Hand held and a VMTI for security purposes. The WC Team borrowed the Hand Held unit to help during night patrols and while it was great for spotting wildlife, it did not work well with the mobile nature of wildlife control. It was at this time the WC Team looked into funding for a VMTI. A Thermal-Eye 4000M, with a 10.4" LCD Monitor (12VDC) was purchased for under \$12 thousand dollars. It is a mounted thermal imaging camera system developed specifically for maritime security and law enforcement applications. Due to the harsh winter season in Cold Lake, the WC Team wanted something that would be unaffected by rain, fog or snow.

### **How does a Thermal Imager work?**

Visible light, the rainbow of colors that can be sensed by the human eye, is electromagnetic radiation within a certain frequency band. 'Infra-' means 'below' and 'red' is the lowest frequency in the visible spectrum. Hence, 'infrared' (or 'IR') refers to that range of electromagnetic wavelengths just below that capable of sight by the human eye. In the IR range, energy from a scene is not sensed by sight (light) but rather by temperature. Most objects that you see are not radiating visible light but instead, are reflecting light radiated from another source. Most objects have to be heated to extreme temperatures before they radiate energy in the visible light spectrum. However, energy in the infrared range is being *radiated by all objects* that are above absolute zero (-273°C/-459°F). Hence, everything has a thermal signature, regardless of light conditions. (Thermal -Eye 4000M manual, 2006.) The ability to detect and measure thermal energy emitted from an object is known as thermography. The tools of the trade are called infrared cameras, and they translate the invisible infrared spectrum into thermal images that we can see and track via thermography. Light that is not visible because its wavelength is too long to be detected by the human eye is referred to as thermal or infrared energy – and is the electromagnetic spectrum range that we perceive as heat. Everything with a temperature above absolute zero emits heat, which means that it may be tracked and measured via thermography, (Even ice cubes, emit infrared.) Infrared thermograph allows us to see, and measure, what our eyes cannot. (FLIR Systems web page)

### **The Thermal Imager In Use**

The Thermal-Eye 4000M allows the WC Team to see without being seen, as well as protects the pilots from confusing spotlights or spotlight beams interfering with their night vision. The joystick is easy to use, and allows the WC member to keep both hands on the wheel, especially during a high-speed chase. With the spotlight, the WC Team first had to see the eyes, keep the eyes in sight while getting close enough to determine the species. If the animal ran, the WC Team would have to chase it, while keeping it in the spotlight, until they were close enough to deal with the animal.

The VMTI is a great tool to use in bushed areas as light reflects off the foliage and the infrared from wildlife within the bush is radiated through the foliage, allowing better detection in both day and night conditions. The WC Team has had to use this feature to track and destroy a dangerous black bear hiding in thick brush. The WC member scanned the bush, got a clear image of the agitated bear and took the shot, killing the bear without actually seeing the animal with their naked eye. With the VMTI the WC Team can determine if a deer is within the GRA fence without driving the entire aerodrome, as the fence also gives off thermal energy and can be clearly seen on the screen. With the spotlight, the WC member would have had to drive over to the area the eyes were last seen and see if the animal is even within the restricted area. The WC Team uses the VMTI during the day to detect wildlife bedded in tall grass, hiding in wooded areas and for scanning for wildlife on an active runway.

The VMTI is useful when scanning for birds as well as mammals, especially for species that migrate at night. The ones you can hear but aren't sure where exactly they are - one mile away or right over the approach! During dusk the WC member will have the imager pointed up towards the sky, while visually inspecting the ground for mammals. This allows the member to completely ascertain the risk level prior to any aircraft taking off or landing.

Features of the Thermal-Eye 4000M:

- Detects human activity from up to 450 meters (1500ft) away,
- Minimum focus distance approx. 25 ft/8 m,
- Automatic focus,
- Operating temp -40°C/°F to 55°C/131°F,
- Continuous 360 pan and tilt for long range detection,
- Unaffected by light rain, smoke, dust,
- Joystick and monitor,
- Video out for remote monitor or VCR, and
- The Infrared won't 'bloom' or become blinded when hit with bright lights such as the taxi and runway lights or ramp floodlights.

### **Drawbacks to using the imager**

Anything directly in the Sun will not be picked up, as the Sun's heat signature will overwhelm that image. The same effect happens if the animal is standing in or in front of something with a greater heat signature – a fox hiding in a culvert on a sunny hot day.

The WC Team also found that the VMTI loses clarity during heavy rain or heavy fog situations. Not losing the picture entirely but the image becomes too grainy to pick out details.

Although the imager's operating temperature is -40°C/°F, the WC Team found that the Pan/Tilt operation was affected by icing. Ice would build up in front of or along the tilt plane, preventing the camera from opening or closing properly. A hood/cover is recommended when the camera is not in use, and if able the vehicle should be parked inside a heated garage.

### **Conclusion**

The Thermal-Eye 4000M, is easy to use, and works well in most conditions experienced in a Northern Alberta climate. Having a mobile unit versus something stationary such as attached to the tower, allows for better scanning at the ground level where the action is. It allows the WC personnel to keep the animal in "sight" at all times, during a pursuit, once the animal takes cover or in areas that are obstructed from the stationary camera's view. Further study will be required to determine if the VMTI has a positive effect on the number of bird/wildlife strikes experienced by 4 Wing, but in the two years of use the VMTI has become an intricate part of the WC arsenal, greatly increasing flight safety.

### **Reference and Further Information**

Thermal-Eye 4000M User Manual.

[http://www.thermal-eye.com/Upload/files/MOBILE\\_AIR\\_LAND\\_SEA/4000B/4000MManual.pdf](http://www.thermal-eye.com/Upload/files/MOBILE_AIR_LAND_SEA/4000B/4000MManual.pdf).

FLIR Systems web page, About Thermography. <http://www.flir.ca/about/>

For more information on the Thermal-Eye 4000M in Canada contact:

Paul Christensen- General Manager Maritime Service.

Tel 604-297-1232, Email: [paul@maritimeservices.ca](mailto:paul@maritimeservices.ca)

For more information the VMTI being used at 4 Wing Cold Lake contact:

Kathleen Gurski – Deputy Wildlife Control Officer

Tel 780-840-8000 ext 8842, Email: [gurski.ka@forces.gc.ca](mailto:gurski.ka@forces.gc.ca)