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Thermal Imagery Applied to Reducing Bird Hazards to Aircraft at Airports

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Airports worldwide are at a disadvantage when it comes to being able to spot birds and warn aircrews about the location of flocks either on the ground or close to the airfield. Birds simply cannot be easily seen during the day and are nearly invisible targets for planes at night or during low visibility. Thermal imaging (infrared) devices can be used to allow ground and tower personnel to pinpoint bird locations day or night, thus giving the airport operators the ability to launch countermeasures or simply warn the aircrews. This technology is available now, though it has been predominately isolated to medical and military system modifications. The cost of these devices has dropped significantly in recent years as technology, capability, and availability have continued to increase.

Davison Army Airfield (DAAF), which is located about 20 miles south of Ronald Reagan National Airport in Washington, DC, is the transient home to many bird species including an abundance of ducks, seagulls, pigeons, and migrating Canadian geese. Over the past few years, DAAF implemented a variety of measures in an attempt to control the bird hazards on the airfield. Unfortunately, when it came to controlling these birds on or near our runways and aircraft movement areas we were more reactive than proactive. We would do airfield checks several times an hour to detect and deter any birds in these areas. The deterrents used included vehicle/human presence, pyrotechnics, and the periodic use of a trained border collie. At the time, we felt like we were doing all we could to reduce the threat to aircraft and human life.

It was not until a near fatal accident in October 1998, when we truly realized how dangerous our operating environment really was to aircraft at or near the airfield. It was at this time, we had a C-12 (twin-engine passenger plane) land on our primary runway at night. The tower cleared the aircraft to land, and upon touchdown to the runway the aircraft collided with a flock of geese. Neither the tower nor the crew of the aircraft saw the geese because they were obscured in the darkness. The end result was 12 dead geese and $374,000 damage to the C-12. Fortunately, there were no human fatalities, but it was painfully clear we needed to improve our method of clearing the runway at night and during low visibility conditions. It was through this realization that we ventured to the U.S. Army Communications and Electronics Command for ideas on ways to deal with our threat. It was through a sub-organization within this command, Night Vision Labs, that we realized the possibilities of modifying thermal imagery and infrared technology to detecting wildlife on airports.

Davison Army Airfield now utilizes a multifaceted approach to eliminate bird strikes on the airfield. The forefront and foundation of our program is using thermal imagery with infrared capability to detect all hazards on the airfield and around our aircraft movement areas. We are currently in the testing stages of various types of thermal devices. The primary thermal device is placed on top of our tower for obtaining a maximum observation area. It is secured on a tripod and motorized 360 degree mount. The device is controlled remotely by a computer (located in the tower) for automatic continuous surveillance. The system also has a manual override for close up viewing of targets. In addition to this device, we have tested 'hand-held' thermal devices (they look similar to home video cameras). These can be used while driving around in the airfield services vehicles during airfield checks.

The complete detection system can be configured in many different ways to produce success. The system works effectively with just the thermal imager and monitor within the tower. When configured this way the tower can do a manual scan of the runway and surrounding area prior to aircraft taking off or landing. A more complete, self-sufficient system will use either Video Detection Monitors (VDM) placed around the entire operating perimeter or a software package known as "Automatic Target Recognition" (ATR). The VDMs are sensors that detect heat and motion within their designated area. They are connected to the main thermal unit on top of the tower by thin cables. When a VDM senses both heat

and movement in it's scanning area, it signals the thermal unit to stop scanning and automatically zooms in on that area.

The ATR computer works similar to the VDM's, however it incorporates a database of thermal images stored in the computer to determine what it is detecting prior to initiating the alarm. The thermal device continuously scans the airfield and the entire perimeter, feeding the information into the ATR computer. The ATR constantly compares the video thermal information to objects that are stored in its database on known objects. The thermal unit will automatically zoom in on the object when heat is detected. The ATR software now sets to the task of analyzing the object against known hazards to determine if that object is a human, vehicle, bird, deer, or any other hazard to aircraft. The total time from pickup to processing of an object and the correlating alarm is reportedly far less than thirty seconds.

Both systems rely on human verification to complete the targeting process. In either case, once an object is identified and has a possibility of being a hazard an automatic alarm goes off. The alarm can be located in an array of locations. We are modifying the tower, airfield services/operations, and base operations with monitors and alarms. Once the alarm is sounded the thermal unit remains on the object and allows these organizations to pin point the location, reset the alarm, and take the proper action. Everything the thermal device sees can be displayed on remote monitors in various locations around the airfield.

As of right now, in conjunction with Night Vision Labs, we have a test thermal device called "Loris" made by Inframetrics. This device will detect a human at 6.5 kilometers and a goose at about 3 kilometers 24 hours a day in any weather condition. Positioned above the tower, this device can clearly recognize just about any heat source on this airfield under all conditions. There are two other devices that will be tested at DAAF in the near future. Raytheon has a system called Argu Falcon that will see out to 6.4 kilometers and another unit called the MAG 2400 that will see out to 4 kilometers. Night Vision Labs are providing the technical expertise and information and the testing equipment. Mr. Jim Miles (Director from Night Vision Labs – jmiles@NVL.army.mil) has spearheaded the project and is a continual part of the testing.

We plan on testing all three different thermal models side by side in the near future. This testing will take some time but the preliminary results have been well beyond our expectations. The FAA is very interested in the testing and plan to write a full technical report on its success and capabilities.

The cost of these systems are very reasonable considering the alternatives. Expect to pay $60,000 to $100,000 for a thermal device and between $5,000 and $25,000 for the primary detection system. There are many combinations of options out there to meet the individual needs of each airport. We are now looking at using Marine radar (the type used on expensive boats) as our primary detection system. The use of marine radar will cost only around $8,000, but will cover several miles. Most major airports use Airport Ground Radar anyway and this could be plugged into the Thermal control computer as a primary detection. In other words, the radar spots a target on the airfield and tells the thermal device to locate it and zoom in. Once the thermal device has the target locked on, the alarm sounds to alert someone that there is something out there that could pose a danger to aircraft.

The use of thermal equipment has proven to provide a twofold advantage: First it allows us to see all activity on this airfield that could pose a hazard such as geese or deer near the runway during day, night, and adverse weather conditions. Secondly, it enhances any Force Protection package because anyone who tries to penetrate the perimeter or venture into secure areas will be seen under all conditions.

The time has come that we all take a more proactive approach to detecting wildlife hazards on and around our airports by taking full advantage of what is already available. We have all been at the mercy of the birds for long enough, now there are technological devices available that allow us to see under all conditions and gives us the advantage over our winged adversaries. It is a solution we can *all* live with. For more information on this and similar technology contact one of the sights below:

Thermal devices www.inframetrics.com < http://www.inframetrics.com>
www.raytheon.com/rtis/docs/thermal.htm

Bird control	www.faa.gov/arp/strkrpt.pdf www.airsafe.com/usda/birds.htm www.acc.af.mil/public/combat-edge/
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