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## The Magic of AIP Funding

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By Ronnie L. Garrett

# The I-Team

*In the war of bird vs. airplane, infrared bird detection technology can help. The Interceptor from Pharovision arms air traffic controllers with timely information to neutralize the threat.*

In September, the FAA reported three bird strikes in a four-hour period at New York's LaGuardia Airport. No one was injured, but the potential for tragedy exists anytime there's a bird vs. airplane incident.

Though bird strikes occur infrequently—the FAA reports just 30 per day out of 50,000 civilian aircraft movements—they can cause a plane to crash. The most notable incident of this type, known as the "Miracle on the Hudson," occurred when US Airways Flight 1549 made an unpowered emergency landing in the Hudson River after multiple bird strikes caused both jet engines to fail. Though all 155 people on-board survived due to the heroic actions of Captain Chesley B. "Sully" Sullenberger, the incident left a lasting impression on what can happen when bird strikes occur.

Six years after this crash, LaGuardia Airport and the FAA partnered to trial a new automated infrared bird detection system from Pharovision. The system is designed to help prevent collisions between aircraft and birds, in air. Dr. Nicholas Carter, finance director of the World Birdstrike Association, explains that while airports currently do many things to prevent aircraft from encountering birds on or next to the runway, little is done once the plane leaves the ground.

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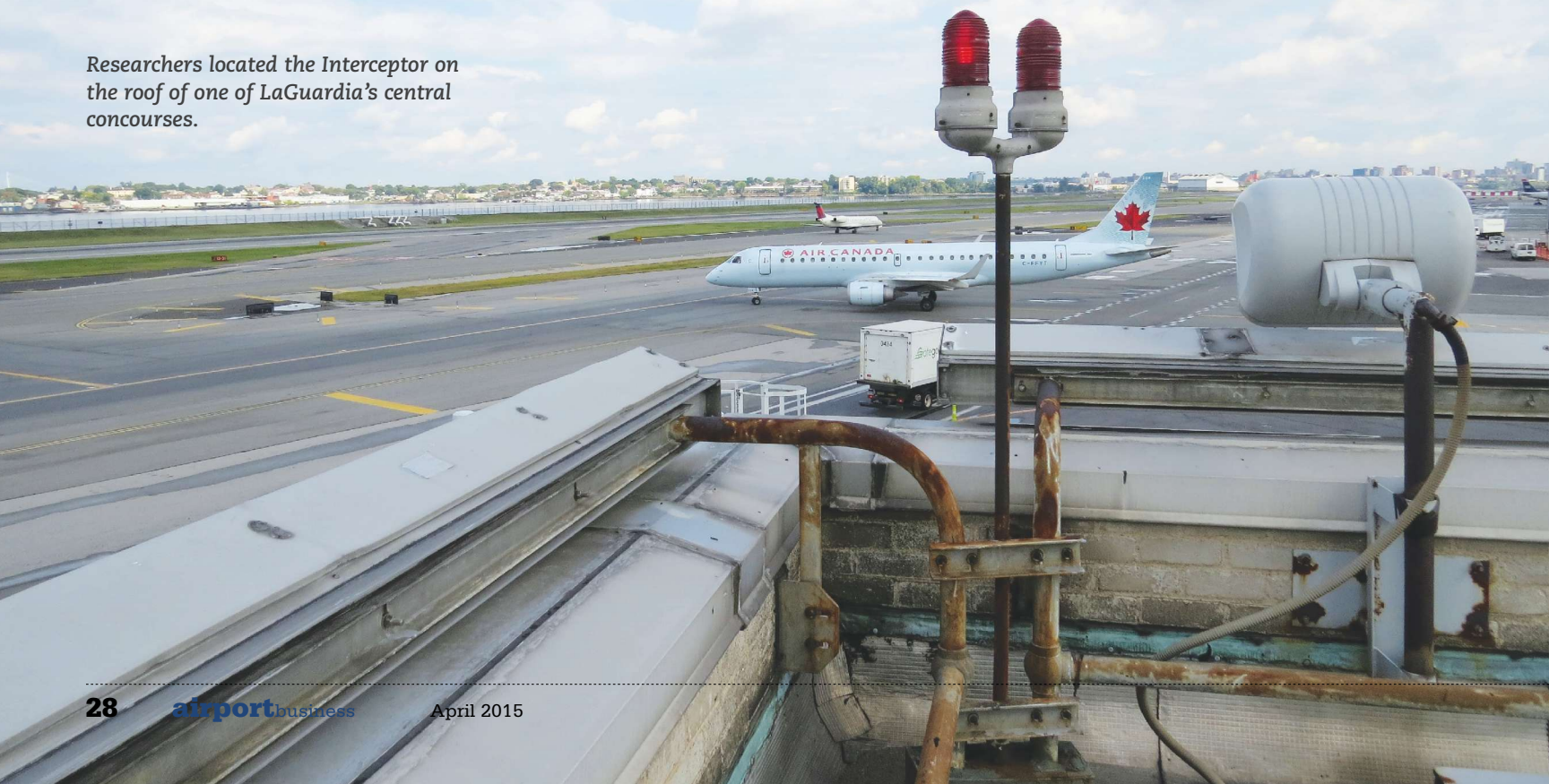



*Researchers located the Interceptor on the roof of one of LaGuardia's central concourses.*

hand, they can mitigate the possibility of a serious bird strike by altering the timing or flight path of an aircraft," he says. "If, for example, controllers (and thereby the pilots) had been aware of the flight path of the flock of Canada geese traversing the airspace outside of LaGuardia, Flight 1549's departure could have been delayed by 30 seconds or the climb-out altitude could have been altered in order to avoid crossing paths with the birds."

## THE PORT'S PILOT PROGRAM

"The FAA conducts a great deal of research concerning wildlife hazards with aircraft," says Marcia Alexander-Adams, spokesperson for the FAA Office of Communications. "This includes investigating many new technologies for mitigating wildlife as well as systems that can better monitor and detect their movements."

After observing a brief demonstration of Pharovision's Interceptor outside the airport environment, FAA officials agreed the next logical step was to demonstrate the system in an airport setting. They then partnered with the Port Authority of New York and New Jersey to install the system at LaGuardia from October 2014 to February 2015.

According to Laura Francoeur, chief wildlife biologist for the Port Authority of New York and New Jersey, the goals of the demonstration were to test the system as a possible alternative to bird radar at a major metropolitan airport.

For the trial, researchers installed a single Interceptor system looking out over the Bronx and the East River/Eastchester Bay, the area where Flight 1549 encountered the flock of geese. Researchers located the system on the roof of one of LaGuardia's central concourses, near the end of the concourse closest to active runways.

According to Carter, this site was chosen for a number of reasons:

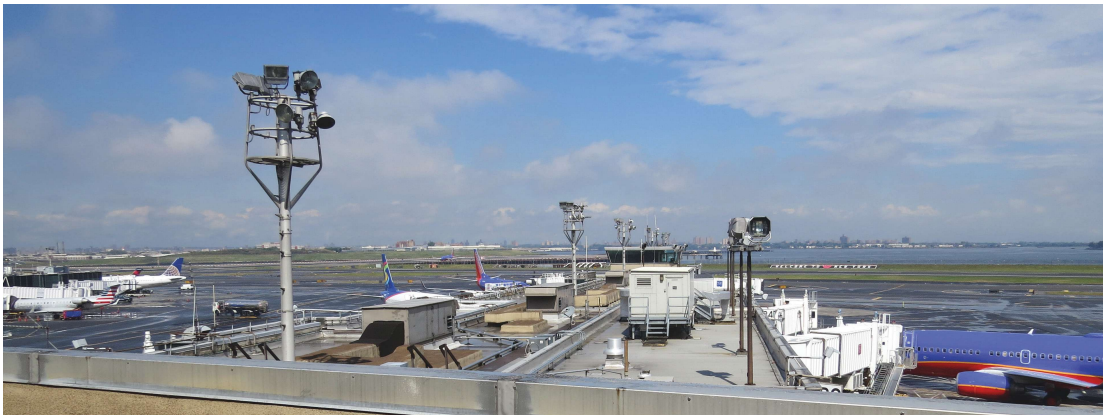
1) Ease of access,

2) The infrastructure already in place to support the system,

3) A nearby ramp control tower where personnel could operate the system while still seeing the whole airfield and surrounding environment (to verify detected targets, etc), and

4) A (mostly) unobstructed view of the bay and the majority of the airfield.

Within the first four hours after deployment, Carter states airport personnel discovered two significant and serious bird strike hazards that had gone unnoticed. The system detected a number of large cormorants flying in the late afternoon through the approach to Runway 04/22 to roost for the night on the pier supporting the approach lights for Runway 13/31. More than 100 of the sizable birds were spending the entire night, perched just meters below the oncoming aircraft landing on Runway 13. Even airport personnel dispatched to the beginning of the pier equipped with binoculars were unable to observe the roosting birds from their position roughly 1 kilometer away, despite the fact that the birds were clearly visible with Interceptor, located an additional 2 kilometers further from the roost site. Additionally, Carter reports the



*The Interceptor had a mostly unobstructed view of the bay from its perch during its trial at LaGuardia Airport.*

## INTERCEPTOR'S OTHER USES

**THOUGH** designed to prevent bird vs. aircraft incidents, Pharovision's Interceptor also offers other solutions for today's busy airports, states Dr. Nicholas Carter, finance director of the World Birdstrike Association.

- **FOD detection.** The system can be utilized as an automated foreign object debris (FOD) detection system, capable of detecting any object on a runway or taxiway surface from more than 800 meters away. Though one unit is not sufficient to cover a typical runway, several units in combination can be employed to automatically scan the tarmac as well as any adjoining taxiways and other surfaces.
- **Security.** The Interceptor can be used as a security system, capable of scanning the entirety of a perimeter fence and notifying the user of any potential intruders. Because it operates in the infrared and does not rely on pressure/touch sensors, it can serve as a "virtual fence," functioning in areas where no fence exists. If, for example, flight operations at a particular airport cease at 11 pm, the system can be placed in a security scan mode to detect potential intruders along the airfield perimeter fence line then returned to bird detection the following day when flight operations resume.
- **Enhanced Airfield View.** The system enables air traffic controllers to see everything on the airfield, basically turning the dark of night into day. The enhanced visuals provided by the system allows them to view situations such as wingtip clearances, vehicular traffic, aircraft on the ground and in departure/arrival corridors, and even personnel moving about on the ramp.

system detected a second substantial roost of gulls, located on the lighting pier of the departure end of Runway 04, roughly 1 kilometer from the runway overrun and actually several kilometers closer than the site of the bird strike by Flight 1549. Again, airport personnel deployed to the end of the runway were unable to see the birds at all, despite the fact that dozens of large gulls were perched directly below the flight path of all aircraft utilizing that runway.

Francoeur states the system is "another potential tool to improve the efficiency of a wildlife management program at the airport" but adds further study is warranted. "We were able to detect some bird activity over the George Washington Bridge, but detection varied greatly, depending on bird size, distance from the airport and other environmental factors," she says. "The system also detected some rat activity near the perimeter fence bordering Flushing Bay in the evening and we have responded to that with changes in our rodent management program."

Alexander-Adams adds a comprehensive analysis of the results by the FAA will take a year or more.

## AUTOMATED DETECTION

The Ministry of Defense originally developed Pharovision's automated infrared system, known as Interceptor, for detecting rockets and small gliders being launched over borders by terrorist organizations and other enemies. Developers later modified the system to automatically detect birds utilizing airspace around an airport, as well as birds and other wildlife (like deer, foxes, etc.) on the airfield itself. The system warns air traffic controllers of the threat, who can then modify flight paths or delay aircraft departures briefly to prevent the flight paths of aircraft and birds from intersecting.

The Interceptor, which runs $200,000 to $600,000 depending on the modular components an airport requests, consists of several components, though the sensor unit itself is small enough to fit on a tripod on the top of an airfield antenna. The sensor unit transmits data back to a computer array, which displays panoramic and high-resolution images, an aerial map overlay, and all detected targets on a number of monitors, along with relevant data on the targets such as azimuth, elevation, size and range.

The system uses an infrared and electro-optical scanning payload and advanced proprietary image-processing algorithms to automatically detect individual birds and flocks of birds, day or night. It is also capable of manual user control, allowing users to observe further, track targets and study specific targets on a real-time basis. The Interceptor system produces visual imagery, which enables users to positively identify detected targets and determine the altitude, behavior, individual numbers or group size, and contextual placement within the actual environment. In addition, the basic system is completely passive, causing no electromagnetic interference with other systems. It can be controlled from a remote station, far from the payload, using an Ethernet link, or link through fiber optic cable or radio frequency signal.

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> **NICK CARTER, FINANCE DIRECTOR, WORLD BIRDSTRIKE ASSOCIATION**

"Air traffic controllers are too preoccupied to be staring at a screen waiting to see birds enter their field of view," states Carter, who emphasizes a bird detection system must be automated.

The Interceptor system is capable of automatically warning air traffic controllers when predefined levels of birds or wildlife are in close proximity to an area that could impinge on aircraft flight corridors. "Other systems require user interaction to scan and detect targets," he says.

The system displays all detections as true visual images of the targets themselves. An operator can easily assess the types, numbers and locations (especially altitude) of detected targets without extensive training or understanding of a complex representative system. "Unlike radar output, Interceptor's images are simply enhanced visuals and are not electronic signal returns translated onto a flat, two-dimensional model of the airport environment," Carter says. "An observer can actually see the individual birds present in the context of the surrounding environment and can view target behavior."

When scanning in automated detection mode, the system follows a series of predefined scan regions, looking for variability in thermal or

*The Interceptor warns air traffic controllers of potential threats, and they can then modify flight paths or delay departures briefly to prevent flight paths from intersecting.*

optical images. The system can be used with either the infrared camera or the electro-optical video camera conducting the detections. Currently it is not capable of scanning and performing detections with the FLIR and CCD cameras simultaneously, though the detection cameras can be switched with the simple push of a button.

As the automated scan proceeds, the system highlights detected birds with a green (or user-defined color) box on the panoramic display. Each target is delineated with its own highlight box and as the scan proceeds, the system updates the visual highlights to show the latest three scans on the panoramic display, removing highlighted boxes where birds are no longer detected. This allows a viewer to see the movement of a bird within the environment, at the same time not creating an overload of warnings with historical detections. Audible warnings or advisories can be associated with target detections or, as the system is currently configured, associated with a critical mass of target detections defined by the user.

Users also can set a bird threat level, or "Bird Watch Condition," to correlate with variable levels of bird detections. Once a predefined threshold of birds is reached, a visual and/or auditory warning could be announced, associated with Bird Watch Condition "Moderate" and "Severe" (or "Yellow" and "Red"). Users could modify these levels as conditions warrant or throughout changes in yearly migratory patterns. They could also change them daily or hourly, with differing threat level advisories based on variable bird movements. The Interceptor records its output, which can be replayed at any time, to allow officials to review the incident later. Depending on the size of the hard drive incorporated, the system allows for continuous and uninterrupted recording for weeks or even months at a time. Users can extract video clips or still images in any number of ways. "There are immense benefits of employing recorded video clips in lieu of written reports to demonstrate the actual hazards present in the environment in order to request specific actions be taken to mitigate identified risks," says Carter.

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## FUTURE FOCUSES

Ultimately, a significant challenge facing deployment of this type of system is its integration into the daily operations of air traffic controllers. Carter explains, "Currently, no concept of operations (CONOPS) exists for incorporating wildlife detection systems in air traffic operations." Alexander-Adams reports the FAA plans to develop an Advisory Circular to assist those airports interested in employing an automated infrared system to best determine the minimal requirements of such a system. She adds that the FAA will also, in the near future, evaluate the precise capabilities of the system in a more controlled environment with known targets of specific sizes and distances. "Something not possible in the real-world environment of the busy LaGuardia airport and surroundings," Carter states.

Pharovision is also working to enhance the capabilities of the Interceptor as well as improve the user interface and operator interaction, and refine the secondary usages such as foreign object debris (FOD) detection. "The system will be (in the next month or so) tested to verify conformance with the FOD detection requirements under the FAA's existing A/C on FOD systems," states Carter. "The Israeli Air Force is implementing 25 to 35 of the systems at all of its major airbases for usage as FOD detection systems, with the added benefit of conducting wildlife detection (though FOD detection will be the principle function)."