Illuminated Insights

FROM THE EDGE OF AI, FOR AIRFIELDS



InspectEX: The Standard or Premium System?

Advancing Airfield Intelligence: Driver Familiarization with Live ADS-B

44 WEEDS:
THE HIDDEN VALUE OF
NON-HAZARD DATA

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LOOKING AHEAD

Message from Brian Freed, CEO



For those of you who have followed Illuminex AI for a while, you may have noticed that we've recently changed our tagline from "Inspection Redefined" to "Airfield Intelligence." That change was not a marketing campaign. It was a deliberate signal of the vision we had been building toward all along. Airfield Intelligence seeks to deliver the technology that answers the following questions: What if your airfield had eyes? And a memory? And someday the ability to use that information to predict the future?

That question has shaped our products and presentations over the last several months. The tagline change was simply the public expression of it.

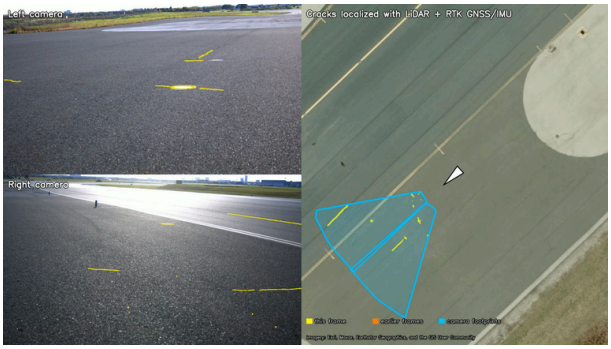
While most of you know Illuminex AI for our flagship product FOD^{AI}, which is currently in operation at airports around the globe, FOD detection was always the starting point rather than the destination. It is the initial use case for a mobile data capture platform that lets us do so much more than find debris. The same sensor fusion system that supports FOD^{AI}, PIDS^{AI}, Surface^{AI}, and numerous other detector and safety use cases also creates the foundation for high fidelity digital twins and airside driver training simulators. In the past few months, that broader vision has moved from concept into tangible form through interactive training environments that deliver a 3D model of the airfield with real time insertion of ADS-B and other tracking data.

The goal remains the same one we had when we changed the tagline: true airfield intelligence. Knowing where everything was, where everything is, and eventually where everything will be, delivered through a single platform that creates economies of scope for airports of every size. This quarter we moved from idea to concrete deliveries and partner demos of both solutions. We delivered the InspectEx Airside Driver Training Simulators to two airports just in time for winter operations training. The simulators use airport specific 3D models built from multiple sources of data, including the InspectEx sensor fusion platform that is the foundation for FOD^{AI}, enhanced by automation and AI upscaling.

At NAC, SWIFT, AMCO, and other conferences attended over the summer and fall, attendees were able to drive our airfield familiarization simulators for Toronto Pearson, Morristown Municipal, and Savannah Airport. We also integrated live ADS-B traffic from 1200.aero to allow live interaction in the simulator with real time or previously recorded air traffic, as well as an "Eye of God" overhead view that provides a 3D aerial view of a real time digital twin of the airfield.

Our goal is to deliver economies of scope by leveraging our Sensor Fusion platform as a mobile data capture solution that accelerates the creation of a true airfield intelligence model for predictive maintenance, operational training, and situational awareness. That model is cost effective and available to airports of all sizes, not just global hubs.

Digging into our detector platforms, Surface^{AI} saw strong advancement under the OVIN Stream 2 program in collaboration with Toronto Pearson. In October we were on site and demonstrated the system's ability to effectively capture surface distress. Using the same premium sensor system that powers FOD^{AI}, Surface^{AI} was able to accurately capture crack and stress data across a ninety-foot-wide swath while moving forty kilometres an hour down the runway. We anticipate moving this from prototype into beta in Q1 2027 and expanding our tests to additional airport locations in that timeframe.



FOD^{AI} remains in active use across multiple airports. Pittsburgh International hosted real-world testing through its xBridge program. Over six months across eight airports, our systems recorded 2,139 classic FOD detections and 1,873 soft FOD during on-airfield testing. Our FOD^{AI} Premium system successfully passed AC 5220 detection criteria across a hundred-foot width at eighty kilometres an hour. We anticipate moving to beta with FOD^{AI} Premium in Q1 2027.

We sponsored and exhibited at the F. Russell Hoyt National Airports Conference in New Orleans, where I was able to participate on a panel focusing on airfield intelligence. Our booth allowed people to experience our Morristown Airport digital twin, our driver familiarization training, and to better understand the expanding use cases for our mobile data capture platform.

From an industry pulse perspective, the Runway Surface Awareness and Focused Effective Training and Technology Act advanced through the Senate Commerce Committee in September. This bill establishes a FAA task force to improve movement area driver training and allows airports to use existing Airport Safety and Resilient Infrastructure Discretionary Program funding for technology and technology enabled training.



DIGITAL TWIN OF MORRISTOWN MUNICIPAL AIRPORT

We believe this will drive demand and increased industry interest in airside driver training, particularly training that uses a current airfield model with current markings and live traffic as a practical way to raise consistency in recurrent training without taking live surfaces out of service. Our InspectEx airside trainer is built exactly for that environment.



Broader momentum continues toward digital twins for training and scenario testing, continuous surface monitoring, and human in the loop AI enhanced inspection rather than full autonomy, with the goal of collecting supporting data not just to identify immediate safety issues, but to support a vision toward proactive and predictive maintenance.

Looking ahead, winter operations will prove out the capabilities of both SnowPro^{AI} and EdgeGuard, supporting winter operations by measuring and preventing excessive drift height within the safety area as well as helping to avoid disruption of edge lights. As the North begins to increasingly focus on winter operations, we look forward to working more closely with our southern airport partners to continue testing and improvement across our suite of products.

If your team is evaluating tools for predictive maintenance, operational safety, simulation, digital twins, and virtual operation centers, we would love to share our vision and collaborate with you to achieve yours.

Yours truly,
Brian Freed,
CEO

InspectEx

Standard Or Premium?

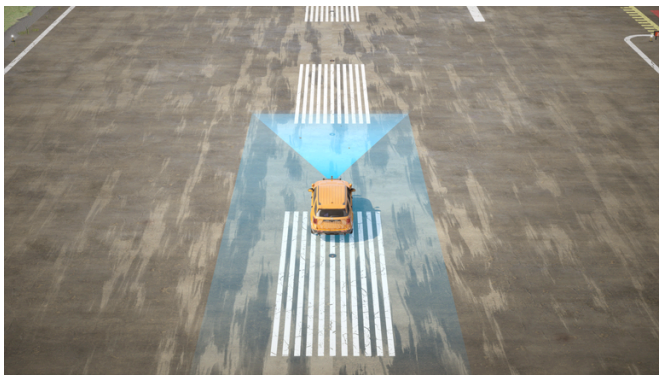
Every airport has different inspection requirements. The size of the airfield, the distance covered during an inspection, operating speeds, and the amount of information an operation wants to capture all influence what makes sense. That is why InspectEx is available in two sensor fusion configurations: Standard and Premium.

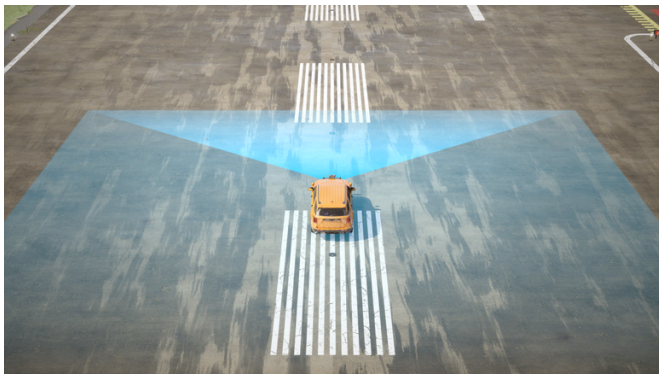
The difference is not simply the amount of technology on the vehicle. It is about how much of the airfield you can cover during an inspection and what information you want to capture while you are there.

Standard: Focused on FOD detection

Standard provides the core sensor fusion capability for automated FOD detection. The vehicle travels the airfield as it normally would, while FOD[AI] identifies foreign object debris during the inspection. InspectEx captures and organizes that information, giving the operation a consistent digital record of what was detected and where it was found.

For an airport primarily focused on improving FOD detection and bringing automated inspection into an existing workflow, Standard provides a practical starting point. Coverage is up to 50 feet with operating speeds up to 50 km/hr.





Premium: More coverage and more capability

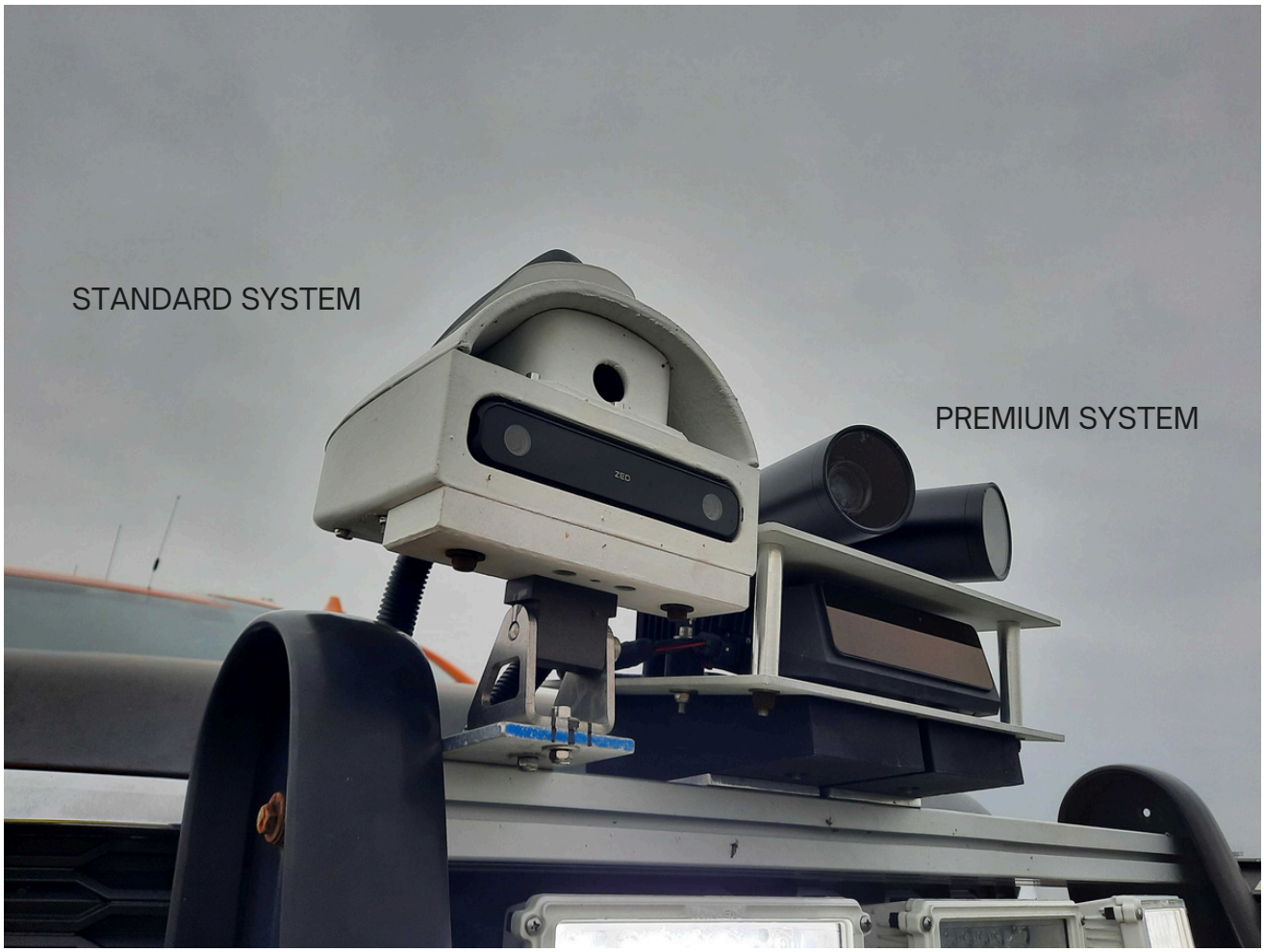
Premium is designed for operations that need to cover more ground, operate at higher speeds, and capture a broader range of information during each inspection. Premium provides inspection coverage of up to 100 feet and operating speeds of up to 80 km/hr. It also adds another camera and LiDAR to the sensor fusion package.

Those differences can matter on a large airfield or in a high tempo inspection program. Greater coverage can reduce the number of passes required, while higher operating speeds can help shorten inspection times. The additional sensing also enables capabilities that go beyond FOD detection, including Surface[AI] for pavement health monitoring.

Our FOD^{AI} Premium system successfully passed AC 5220 detection criteria across a hundred-foot width at eighty kilometers an hour at a pilot site. We anticipate moving to beta with FOD^{AI} Premium in Q1 2027.

Which one fits your operation?

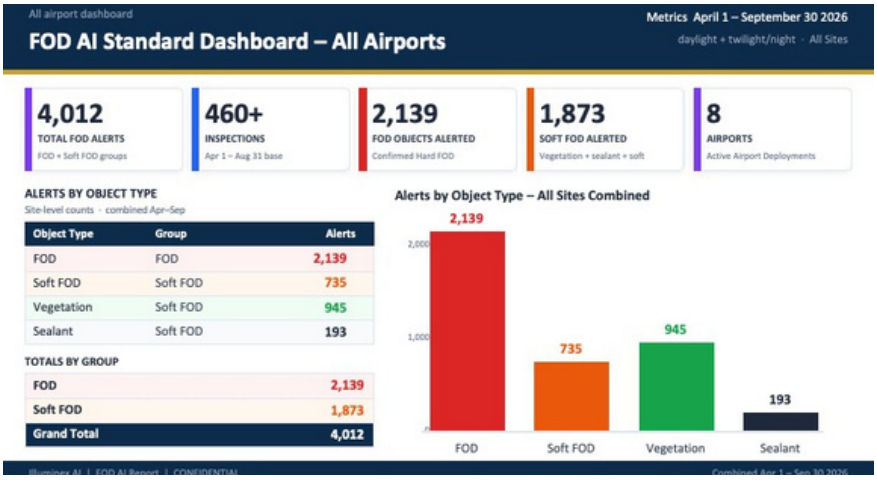
The choice between Standard and Premium comes down to what the airport needs from its inspection program. How much ground needs to be covered? How quickly does the inspection need to be completed? And what does the airport want the inspection vehicle to capture beyond FOD? Those answers can make the choice much clearer.



44 Weeds: The Hidden Value of Non-Hazard Data

Over six months across eight airports, our systems recorded 2,139 classic FOD detections and 1,873 soft FOD detections. Soft FOD represented nearly half of all observations.

Classic FOD has an obvious purpose. A piece of metal, rubber, plastic, or asphalt on an active airfield can create an immediate operational concern. It needs to be identified, reported, and removed.



Soft FOD is different.

These observations may not require an operator to take immediate action. They can include vegetation, evidence of wildlife activity, recurring pavement debris, and other conditions that may be relatively minor when viewed individually. But when those observations are consistently captured, located, and recorded, they become data.



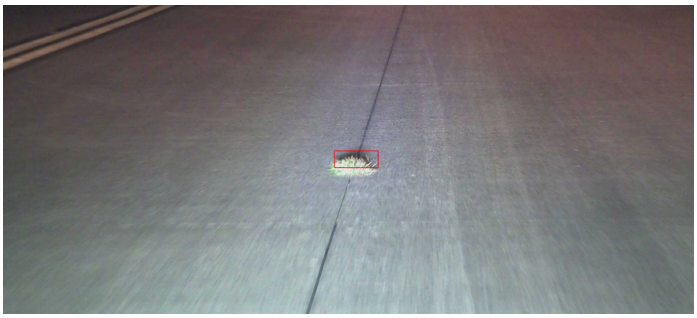
The pattern matters

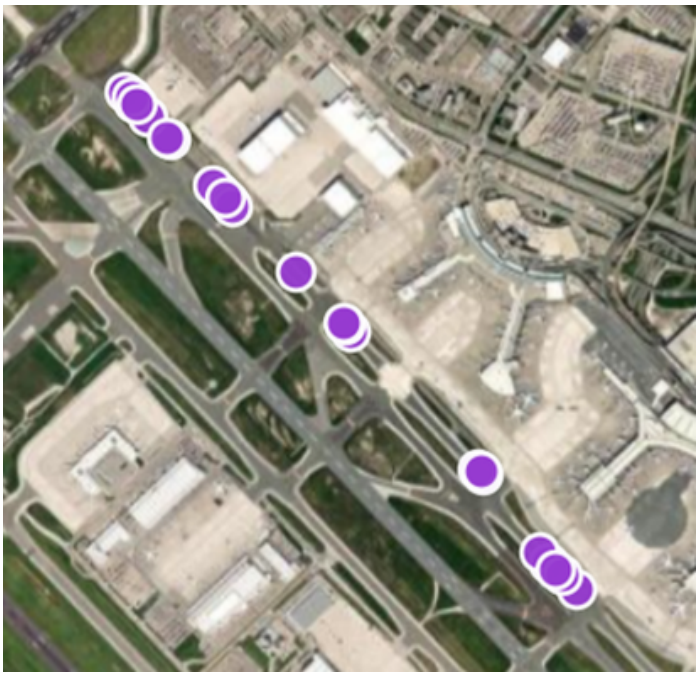
One of the clearest examples came from vegetation. During one inspection, 44 vegetation observations were recorded in a concentrated area of one taxiway. No one would suggest that 44 individual weeds represent 44 significant maintenance events. A weed growing through pavement is not necessarily an immediate operational concern.

The significance comes from the location and repetition. When vegetation repeatedly appears in the same area, it can be a reason to look more closely at the conditions beneath and around the pavement. Moisture, drainage problems, failed joints, or cracking can create an environment where vegetation continues to return. The inspection system did not need to determine that a pavement failure was occurring. It simply recorded what it saw. The value came from having enough observations in the right place to make the pattern visible.

The same principle applies across the soft FOD observations. Wildlife activity, vegetation, and recurring asphalt debris may be minor findings individually. When they are consistently detected and geo referenced, they can reveal concentrations and recurring conditions that are difficult to see from individual inspection reports. That turns an inspection record into a dataset that can be analyzed over time. Some observations need to be acted on immediately. Others become useful because they reveal a pattern. That is the hidden value of non-hazard data.

This quarter we developed a secondary vegetation model for our FOD^{AI} platform. It serves two purposes: first it eliminates audible alerts on “vegetation soft FOD” and second it creates a new “vegetation” layer to the airfield intelligence heat map.





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Advancing Airfield Intelligence: Driver Familiarization with ADS-B

Illuminex AI is taking airfield driver familiarization training a step further by integrating live aircraft movement into our high-resolution 3D virtual environment. This delivers an enhanced level of realism that provides the foundation for better operational training.

Our key goal with operational training and driver familiarization is to give future airfield operators the most realistic possible experience. While you can insert programmatic aircraft and other vehicles into the scene, nothing delivers realism like reality. That is why we are adding real-time or replay of pre-recorded ADS-B traffic into our familiarization simulators. It allows drivers to experience the airfield as it really is, not through programmatic simulations. It also allows training staff to insert drivers into a recorded real-world scenario that is reflective of a particular training objective.

Training the vehicle, not just the driver

Another common complaint we hear from airports using driver training simulators, particularly those derived by adapting Microsoft Flight Simulator as the base, is that the physics of the vehicles being driven does not match the reality of the physics within the simulator. As a result, we continue to add additional vehicles, including two airfield inspection vehicles and now an ARFF vehicle. The distinction matters. A driver training in a large emergency response vehicle is dealing with a very different physical envelope and driving experience than someone driving a pickup truck. The simulator can be built around the characteristics of the vehicle while maintaining the actual airport environment underneath it.







Moving forward, this creates potential for more airport-specific training scenarios that go well beyond driver familiarization. We have already developed reinforcement learning for stop and hold line compliance, and we are looking at additional condition simulation for safety, operational process, and emergency response.

Now with added live aircraft

In addition, the airfield 3D model has now been adapted to support not only driver familiarization and operational training but enhanced operational awareness through the delivery of a Bird's eye view of the 3D airport with real-time ADS-B aircraft rendered into the landscape. This reflects one of our philosophies around economies of scope. A solution should be designed with an intent to maximize use cases, flexibility, and future proofing. The same 3D model that supports driver familiarization training can be delivered on a local PC or hosted on AWS, allowing any authorized airport employee the ability to see a live view of their airfield from any device.



Looking Ahead

Looking ahead, winter operations are going to put driver training simulation to the test at two airports, giving winter ops temporary workers enhanced familiarization of the airfield before they are ever behind the wheel. In addition, we look forward to another year of operational use for SnowPro^{AI}, which measures snowbank and windrow heights so airports can confirm they remain within runway safety area requirements and reduce the risk of snow-related operational disruptions. EdgeGuard, which provides real-time situational awareness of edge light locations to help operators avoid damaging those lights during plowing and other vehicle movements, is deployed on multiple machines this winter. By showing drivers exactly where the lights are relative to their vehicle, it reduces the chance of costly edge light strikes that can take a runway or taxiway out of service. Finally, we look forward to transitioning FOD^{AI} Premium (which expands automated foreign object debris detection to wider coverage and higher speeds during routine inspections) and Surface^{AI} (which continuously monitors pavement condition for cracks and other distress so teams can prioritize maintenance before problems grow) from pilot to beta programs, with deployments planned for additional airports in Q1 2027.

Something we are watching closely is the Runway Surface Awareness and Focused Effective Training and Technology Act, often called the SAFE-T Act. The bipartisan bill, which has advanced through the Senate Commerce Committee, would create an FAA task force to improve movement area driver training and allow airports to use existing Airport Safety and Resilient Infrastructure Discretionary Program funding for technology and technology-enabled training that helps reduce runway incursions and other surface safety incidents. You can read the current text of the bill at https://www.congress.gov/bill/119th-congress/senate-bill/5224. Both improved driver training tools and runway safety systems such as runway incursion warning systems fall squarely into the Illuminex AI product portfolio. We look forward to watching the evolution of this legislation and engaging with the airport ecosystem to help provide effective, available, and future-proof solutions for enhanced operational training simulation and runway safety. If your team is looking for solutions to address these challenges, we would love to talk, share our vision, and better understand your needs.

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