



Illuminated Insights

FROM THE EDGE OF AI, FOR AIRFIELDS

When AI Becomes Part of the Team

BETA PROGRAM:
FIELD TESTED, CREW APPROVED

LIVING AIRFIELD TWINS
MINIMIZING SURPRISE

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Showcased at SWIFT 2025 - Niagara Falls, Canada



By Brian Freed, CEO

Welcome to the second issue of *Illuminated Insights*. Our goal is to provide you with a front-row seat to the journey of exploring how sensor-fusion AI, simulation, automation, and collaboration are transforming safety and maintenance of critical built world infrastructure. We are thrilled to share what we've learned alongside airfield professionals, the progress we've made, and the breakthroughs that are helping teams operate safer and more efficiently.

This summer, our team spent countless hours alongside airfield crews installing systems and performing on airfield testing as we engaged with multiple airports to deploy and test our Airfield FOD detection solution, FOD^{AI}. Long days of travel to and from our beta sites, lost luggage, and the occasional technical hiccup reminded us that innovation isn't built in a lab, it's shaped in the real world, in collaboration with the people who rely on these tools every day. These experiences have taught us as much about our approach as they have about the technology itself: AI is most powerful when it amplifies human judgment, enabling crews to operate safer and more efficiently without disrupting their established and approved operating processes.

As the season progressed, conversations at conferences and trade events reinforced a clear trend: airfields are increasingly moving toward data-rich technologies to enhance airfield efficiency and safety.

AI-based data collection, intelligent airfield assets, real-time data platforms, and airfield training simulations are being utilized for proactive monitoring, enhanced situational awareness and cost-effective and green airside operations training.

In this issue, we share some of the learnings from our FOD^{AI} Beta testing, share insights into the emerging capabilities of living airfield twins, and look ahead to how AI can complement human expertise to shape the next generation of airfield operations.

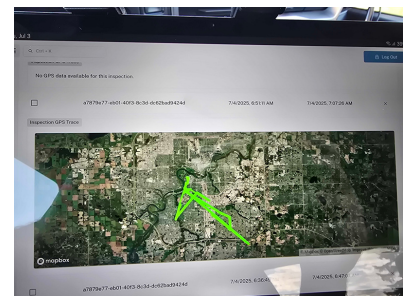
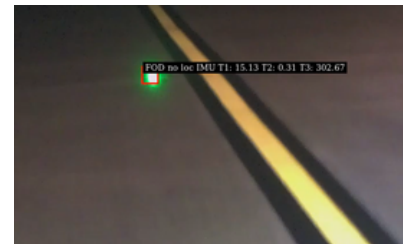
Ten Weeks of Failure, Progress, and Partnership



Ten weeks ago, we launched the FOD^{AI} Beta Program to put our AI-powered Foreign Object Debris detection platform to the ultimate test: the real world. Our goal was simple on paper, validate performance, refine the system, and understand how AI could complement the skill and judgment of airfield crews. In practice, the reality was far more complex, messy, and enlightening.

To capture the breadth of operational conditions, we selected four airports with distinct environments. Morristown Municipal Airport (MMU) represented a small general aviation hub; Savannah/Hilton Head International Airport (SAV) brought coastal humidity; a large Texas airport introduced relentless summer heat and bright sunlight; and a top-tier commercial hub challenged us with high-traffic complexity. Each site exposed different vulnerabilities in both hardware and software, and every failure was a lesson.

We faced camera sensors overexposed to sunlight, protective lenses fogging from humidity, GPS issues from radio frequency interference, and even unexpected interactions with in-vehicle navigation systems. On the software side, variations in airfield lighting, pavement markings, and runway layouts triggered false positive FOD detections. But these weren't setbacks, they were opportunities to learn, adapt, and improve



LESSONS LEARNED

Our team responded quickly. Sensor housings were redesigned, low-level controls were added for lighting adaptation, and GPS receivers with enhanced RF filtering were deployed. AI models were retrained with newly observed objects, and advanced filtering methods were implemented to reduce false positives. In parallel, we rolled out a moving map interface, created directly from inspector feedback. This new interface provides clear, intuitive visualization of FOD detections and inspection routes, giving crews actionable information without distracting from their workflow.

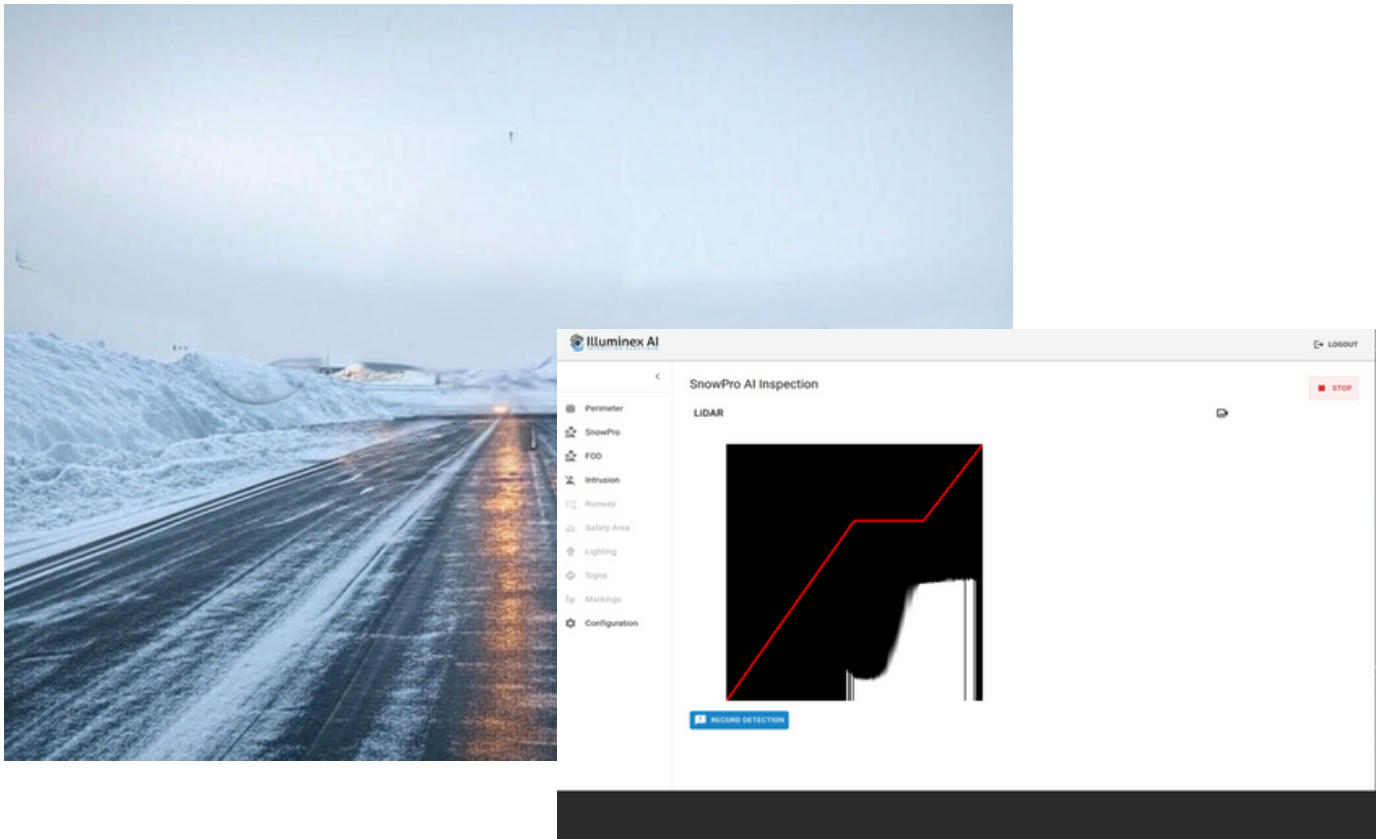


The most important lessons came not from technology alone but from listening to the people using it. Watching inspectors engage with the system, hearing where alerts were most useful and understanding how they navigated the dashboard informed every design decision. We learned where the interface could be clearer, how to present critical data without overload or distraction, and how AI could truly complement human judgment on the airfield.

As a result, FOD^{AI} isn't just more robust, it has evolved to become more thoughtfully aligned with real-world operations. Each iteration strengthened our models, clarified user experience, and reinforced our philosophy: AI works best when it augments the skills of skilled professionals rather than replacing them. AI works best when it augments the expertise of professionals

This Beta program has shown us that meaningful innovation comes from persistent effort, collaboration, and a willingness to embrace the unexpected. Every challenge we face becomes a building block for a platform that is more accurate, resilient, and operator friendly. As we continue to refine FOD^{AI}, the insights gained from these real-world deployments will guide not only this system but the broader suite of AI-driven inspection tools we're developing for airfields everywhere.





Winter on the Horizon: Preparing for Real-World Testing

This winter, we'll be taking our newest technology into the field for the first time. Following a summer focused on refining FOD^{AI} and learning from operations teams across diverse airports, the next challenge is winter airfield operations, a season defined by shifting conditions, tight timelines, and strict regulatory requirements.

Over the coming months, we'll pilot SnowPro^{AI} at several interested airports, observing how it performs while crews are actively conducting winter operations. Our goal is to gain feedback in real operational settings, capturing lessons that will help us refine the product for commercial launch. Snow, ice, and low visibility create a unique testbed, showing us not just what technology can do, but how it fits into the day-to-day workflows of airfield teams.

SnowPro^{AI} focuses on measuring snowbanks along runways and taxiways. Using LiDAR and GPS sensor fusion, it collects geolocated snow profiles, providing crews with real-time insights as they work. By capturing feedback during actual operations, we can understand what features are intuitive, what needs adjustment, and how the system can genuinely support crews without slowing them down.

As the season unfolds, we'll share what we learn: the surprises, the insights, and the practical lessons that only come from testing in the real world. These findings will be highlighted in upcoming issues, offering a closer look at how winter operations and AI can work together to enhance airfield safety and efficiency.



People often misuse the term "digital twin," confusing it with simple 3D representations. At Illuminex AI, we're building toward true digital twins for airfields, but along the way intend to support a variety of different use cases, through direct development or via strategic partnerships, let's break down the gradients:

- **Basic 3D Model** (e.g., Unreal Engine): A static or visual representation of an airfield, great for visualization but lacking interactivity or real-time data.
- **Interactive Model** (Basic Driver Training Simulation): Adds user engagement, like simple navigation in a virtual airfield for AVOP familiarization, teaching rules without dynamic changes.
- **Advanced Interactive Model** (Advanced Simulators): Incorporates equipment operation, multi-user interactions, and complex scenarios e.g., collaborative ground handling, snow clearing equipment, pushback simulations or emergency drills in a simulated environment. While such simulators can leverage developed airfield models, we intend to support this market in collaboration with advanced simulator developers.
- **Digital Twin**: Integrates real-time data into the 3D model, mirroring the physical airfield's current state with live sensor inputs for monitoring and decision-making.
- **Advanced Simulator** (Full Digital Twin): Evolves to include historical replay, current operations, and forecasting with machine-learning-based what-if scenarios, predicting outcomes such as traffic delays from events such as surface closures or weather conditions.

Digital twins are rapidly transforming how airfields operate, plan, and train. At Illuminex AI, we've harnessed recent advances in AI, computer vision, and sensor integration to accelerate the creation of high-fidelity airfield models at a fraction of the traditional cost and time. What once required months of manual surveying and expensive scanning can now be produced in weeks, giving operators actionable insights and immersive simulation capabilities faster than ever before.



ILLUMINEX AI

3D MODEL

The Long-term Value of Digital Simulation

Our approach to 3D modeling combines cutting-edge AI with the craftsmanship of talented technical artists. Using data from cameras, LiDAR, and other sensors, our artists leverage AI and automation to create synthetic meshes, textures, and operational elements that faithfully replicate real-world airfield infrastructure, surfaces, signage, lighting, and more. This methodology allows us to produce 3D models with the fidelity and immersion needed for driver training, operational planning, and scenario analysis while laying a technical foundation for future technologies such as sensor-fusion based neural reconstruction, which combines sensor fusion data and AI to automate and accelerate the creation of 3D virtual ecosystems.



Illuminex AI is positioned to leverage these emerging tools as they mature, integrating them into our pipeline to continuously enhance model accuracy and efficiency. For now, combining AI-driven data processing with expert modeling delivers a digital twin that is accurate, actionable, and ready for simulation, at a fraction of the cost and time of traditional methods.

For airfield operators, that means this isn't just about having a 3D model. It's about having a foundation that grows with them: training the next generation of drivers, planning tomorrow's operations, and laying the groundwork for a fully connected Airfield Intelligence™.

At the SWIFT Conference 2025 in Niagara Falls, Canada, we unveiled our driver familiarization training prototype: Airside driving demands mastery of unique rules and procedures to prevent incidents in high-stakes environments. Our 3D models enable safe, immersive simulation-based training, offering a low-risk way to introduce or reinforce key behaviors. Drivers can practice universal skills like signage recognition, right-of-way protocols, and radio communications, while our airport specific models tackle airport-specific challenges such as complex layouts, low-visibility weather, or construction zones. This approach minimizes real-world risks, boosts retention, and ensures compliance ultimately enhancing operational safety and efficiency.



This was a demonstration of a simulation of Toronto Pearson's airfield. Built on our digital twin process, the model supported immersive driver training scenarios without disrupting live operations. What impressed attendees wasn't just the realism, but the reusability: the same 3D twin of Pearson could just as easily support snow route planning, construction sequencing, or surface condition overlays.

The takeaway is simple: when evaluating driver simulation, don't only look at the simulator hardware or training modules. Ask where the 3D model comes from, how it can be updated, and whether it can be used beyond one simulator. That's where the real return on investment lies.

With Illuminex AI, the simulator isn't the end product, it's one application of a digital twin that grows in value year after year.



Thanks to Fortbrand Services

We'd like to extend a special note of appreciation to Fortbrand Services, an Illuminex AI reseller for inviting us to exhibit along side them at multiple events this year. Their support gave us the opportunity to showcase our innovations directly to the airfield community and to engage in meaningful conversations with operators from across North America.

Collaborations like these are what make progress possible, and we're grateful to have Fortbrand as a partner on this journey.



Want to Learn More?

At Illuminex AI, we always enjoy connecting with industry experts to explore challenges where we can apply our cutting-edge expertise and innovative solutions. Whether you're an airfield operator looking to optimize operations with AI-driven tools, a vendor interested in collaborative integrations, a strategic partner seeking synergistic opportunities, or a venture capital investor eager to discuss our vision for the future of aviation technology, we'd be happy to set up a call, just email us at info@illuminex.ai.

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